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ORGANIC CHEMISTRY IN ITS APPLICATIONS TO AGRICULTURE AND PHYSIOLOGY; BY JUSTIES LIEBIG, M. D. F. R. S., &c., PROFESSOR OF CHEMISTRY IN THE UNIVERSITY OF GIESSEN, &c.

THIS work has been lately re-published in America. The high encomiums bestowed upon it by eminent chemists in Europe and America, give it a degree of value possessed by no work on the subject, since the publication of Sir Humphrey Davy's lectures on agricultural chemistry. Dr. Colman, of Massachusetts, speaks of it as "the most valuable contribution to agricultural science, which has come within his knowledge." Professor Silliman says of it, "its acceptance as a standard is unavoidable, for, following closely in the straight path of inductive philosophy, the conclusions which are drawn from its data, are incontrovertible." Coming, therefore, from one of the most celebrated chemists of the present age, and endorsed by such high authority, the opinions and the facts upon which they are based, are well entitled to our confidence.

We propose, therefore, to make such extracts from the work as may indicate the peculiar views of the author, and whatever else that may be useful to practical agriculture.

The elementary constituents of plants are few, and the difference of form, structure, colour, &c., and all the various products which they yield, are but modifications of these elements: they are carbon, oxygen, hydrogen and nitrogen in small quantities, (but according to Liebig) always present, and the inorganic bases, with which the acid juices of plants are combined, and which are always found in their ashes after incineration.

Carbon is always present in every part of their structure, and in combination with oxygen and hydrogen in the relative proportions for forming water, constitutes the principal mass of every vegetable. Such is the composition of woody fibre or lignin, sugar, starch and gum. When the proportion of oxygen is greater than is required for producing water, an acid is formed. Hence the numerous organic acids found in the juice of plants. In the third class of vegetable compounds, such as the oils, wax, resins and alcoholic substances, hydrogen is in excess over the proper proportions for forming water.

Nitrogen is present in all plants, but more abundant in their seeds, and especially those which contain most gluten or vegetable

albumen. The nutritious quality of a plant depends upon its presence, and it is for this reason that wheat which contains more gluten than any other is so nutritious.

It is to be regretted that chemists and vegetable physiologists have not acted more in concert in the adoption of certain terms to signify that product of the decay of vegetable matter, which in its different forms and modifications, has received the names of humus, humic acid, humin, coal of humus, carbonaceous mould, soluble and insoluble geine, apotheme, ulmin, crenic and apo crenic acids, &c. For every different form under which it presents itself to the examination of chemists, has it received a different name. The transformation of the constituents of vegetables is easily effected, and until the peculiar qualities of these substances are well defined, practical agriculture can derive but little benefit from them. They are all the product of the decay of vegetable matter, and are all rich in carbon, and on this account, according to Liebig, are they valuable as affording nourishment to plants, inasmuch as when in a state of decay, they furnish carbonic acid to the roots.

We now enter into the peculiar views of the author with respect to the assimilation of carbon, which, although not new, are still not universally adopted.

"The opinion that the substance called humus is extracted from the soil by the roots of plants, and that the carbon entering into its composition serves, in some form or other, to nourish their tissues, is so general and so firmly established, that hitherto any new argument in its favour has been considered unnecessary; the obvious difference in the growth of plants according to the known abundance or scarcity of humus in the soil, seemed to afford incontestible proof of its correctness. Yet, this position, when submitted to a strict examination, is found to be untenable, and it becomes evident, from most conclusive proofs, that humus in the form in which it exists in the soil, does not yield the smallest nourishment to plants."—p. 61.

"In the following inquiry, we shall suppose the humus of vegetable physiologists to be really endowed with the properties recognized by chemists in the brownish black deposites which they obtain by precipitating an alkaline decoction of mould or peat by means of acids, and which they name humic acid. Humic acid when first precipitated is a flocculent substance, is soluble in 2,500 times its weight of water and combines with alkalies, lime and magnesia, forming compounds of the same degree of solubility. Vegetable physiologists agree in the supposition that by the aid of water humus is rendered capable of being absorbed by the roots of plants. But, according to the observations of chemists, humic acid is soluble only when newly precipitated, and becomes completely insoluble when dried in the air, or when exposed in the moist state to the freezing temperature.

"Both the cold of winter and the heat of summer, therefore, are destructive of the solubility of humic acid, and at the same time of its capability of being assimilated by plants. So, that if it is absorbed by plants, it must be in some altered form."—pp. 62, 63.

But even admitting it to be taken up in the form of that salt which contains the largest proportion of humic acid, viz. humate of lime, the author proves that it cannot yield carbon sufficient for the growth of the woody fibre really produced by the land. Humate of lime is the most soluble of the humates, and also contains the largest portion of humic acid. On the supposition that all the rain water which falls during the growing season of plants, is saturated with this salt and absorbed by the roots, without taking into consideration the constant evaporation going on, it is still insufficient to account for the quantity of carbon which is actually found in their structure.

"Other considerations of a higher nature, confute the common view respecting the nutritive office of humic acid, in a manner so clear and conclusive that it is difficult to conceive how it could have been so generally adopted.

"Fertile land produces carbon in the form of wood, hay, grain, and other kinds of growth, the masses of which differ in a remarkable degree. 2,650 lbs. Hessian of firs, pines, beeches, &c. grew as wood upon 40,000 square feet of forest land with an average soil. The same superfices yields 2,500 lbs. Hessian of hay.

"A similar surface of corn land gives from 18,000 to 20,000 lbs. Hessian of beet root, or 800 lbs. Hessian of rye, and 1,780 lbs. Hessian of straw, 160 sheeves of 14 lbs. Hessian each, in all, 2,580 lbs. Hessian.

"One hundred parts of dry fir wood contain 38 parts of carbon; therefore, 2,650 lbs. contain 1,007 lbs. Hessian of carbon. One hundred parts of hay dried in air, contain 44 . 31 parts carbon. Accordingly, 2,500 lbs. of hay contain 1,008 lbs. Hessian of carbon.

"One hundred parts of straw dried in air, contain 38 per cent. of carbon; therefore, 1,780 lbs. of straw contain 676 lbs. Hessian of carbon. One hundred parts of corn, contain 43 parts of carbon; 800 lbs. must therefore contain 344 lbs. Hessian; in all, 1,020 lbs. Hessian of carbon.

"40,000 square feet of wood and meadow land produce, consequently, 1,007 lbs. of carbon, while the same extent of arable land yields in beet root without leaves, 936 lbs., or in corn 1,020 lbs.

"It must be concluded from these incontestible facts, that equal surfaces of cultivated land of an average fertility, produce equal quantities of carbon; yet, how unlike have been the different conditions of the growth of the plants from which this has been deduced!

'Let us now inquire whence the grass in a meadow, or the wood in a forest, receives its carbon, since there, no manure, no carbon,

has been given to it as a nourishment; and how it happens, that the soil, thus exhausted, instead of becoming poorer, becomes every year richer in this element?

"A certain quantity of carbon is taken every year from the forest or meadow, in the form of wood or hay, and, in spite of this, the quantity of carbon in the soil augments; it becomes richer in humus.

"It is said, that in fields and orchards all the carbon which may have been taken away as herbs, as straw, as seeds or as fruit, is replaced by means of manure; and yet this soil produces no more carbon than that of the forest or meadow where it is never replaced. It cannot be conceived that the laws for the nutrition of plants are changed by culture—that the sources of carbon for fruit or grain, and for grapes or trees, are different.

"It is not denied that manure exercises an influence upon the developement of plants; but it may be affirmed with positive certainty, that it neither serves for the production of the carbon, nor has any influence upon it, because we find that the quantity of carbon produced by manured lands is not greater than that yielded by lands which are not manured. The discussion as to the manner in which manure acts, has nothing to do with the present question which is the origin of the carbon. The carbon must be derived from other sources; and as the soil does not yield it, it can only be extracted from the atmosphere."—pp. 66, 67, 68, 69.

The author next adduces an argument from the invariable condition of the air with respect to oxygen.*

"One hundred volumes of air have been found, at every period and in every climate, to contain 21 volumes oxygen, with such small deviations, that they must be ascribed to errors of observation."

"How does it happen then, that the proportion of oxygen in the atmosphere is thus invariable?

"The answer to this question depends upon another, viz. what becomes of the carbonic acid which is produced during the respiration of animals, and by the process of combustion?—pp. 70, 71.

"It is quite evident that the quantities of carbonic acid and oxygen in the atmosphere, which remain uncharged by lapse of time, must stand in some fixed relation to one another; a cause must exist which prevents the increase of carbonic acid, by renewing that which is constantly forming; and there must be some means of replacing the oxygen, which is removed from the air by the processes of combustion and putrefaction, as well as by the respiration of animals.

"Both these causes are united in the process of vegetable life. The facts which we have stated in the preceding pages prove, that

* The atmosphere consists by volume of
$\left.\begin{array}{l}\text{21 oxygen}\\\text{79 nitrogen}\end{array}\right\}$ not however chemically united, and about 1—10000 of carbonic acid and watery vapour.

the carbon of plants must be derived exclusively from the atmosphere.—Now, carbon exists in the atmosphere only in the form of carbonic acid, and therefore in a state of combination with oxygen."—pp. 71, 72.

It has been long ascertained by the observation and experiments of chemists, that plants absorb carbonic acid and emit oxygen, when under the influence of light. In lectures on Agricultural Chemistry, page 212, Sir H. Davy says, "The absorption of carbonic acid gas and the production of oxygen are performed by the leaf; and leaves recently separated from the tree effect the change, when confined in portions of air containing carbonic acid; and absorb carbonic acid and produce oxygen even when immersed in water holding carbonic acid in solution." The same fact is mentioned by Liebig. On page 217 of the work just quoted, in a note his brother says, "From the experiments of M. M. Gay Lussac & Thenard, confirmed by those of Dr. Prout, lignin appears to consist of equal parts of carbon and water, and consequently water and carbonic acid are sufficient to form lignin, by means of the decomposing power of the leaves, under the influence of light, the carbon being assimilated, the oxygen liberated."

The mutual action of animal and vegetable life is, therefore, to preserve the atmosphere unchanged. Animals by expiring carbon which is essential to vegetables—and vegetables by absorbing carbon and emitting pure oxygen gas which is essential to animals—a mutual dependance upon each other, which the great Creator has established amongst his creatures.

On the origin and action of Humus.—The definition which Liebig gives to humus is, woody fibre in a state of decay.

"Humus acts in a soil permeable to air as in the air itself; it is a continued source of carbonic acid which it emits very slowly."—p. 105.

"By loosening the soil which surrounds young plants we favour the access of air and the formation of carbonic acid; and on the other hand, the quantity of their food is diminished by every difficulty which opposes the renewal of air."

"A plant at this time receives its food both by the roots and by the organs above ground, and advances rapidly to maturity.

"When a plant is quite matured, and when the organs by which it obtains food from the atmosphere, are formed, the carbonic acid of the soil is no longer required."—p. 106.

"The size of a plant is proportional to the surface of the organs which are destined to convey food to it. A plant gains nutriment and stomach with every new fibre of root and every new leaf.

"The power which roots possess of taking up nourishment, does not cease as long as nutriment is present. When the food of a plant is in greater quantity than its organs require for their own perfect developement, the superfluous nutriment is not returned to

the soil, but is employed in the formation of new organs. At the side of a cell already formed, another cell arises; at the side of a twig and leaf, a new twig and a new leaf are developed. These new parts could not have been formed had there not been an excess of nourishment."—p. 107. "Humus does not nourish plants by being taken up and assimilated in its unaltered state, but by presenting a slow and lasting source of carbonic acid which is absorbed by the roots, and is the principal nutriment of young plants at a time, when, being destitute of leaves, they are unable to extract food from the atmosphere."—p. 117.

On the assimilation of Hydrogen.—This important constituent of the vegetable family, natnre has supplied abundantly in the form of water, and the laboratory in which she prepares it, is the organic structure of the plant itself.

"From their generating caoutchouc, wax, fats and volatile oils containing hydrogen in large quantity, and no oxygen, we may be certain that plants possess the power of decomposing water, because from no other body could they obtain the hydrogen of those matters."—p. 122.

On the assimilation of Nitrogen.—In the preface to the present edition. Professor Webster says, "Although the fact that nitrogen is essential to the nutrition of plants, was known before the publication of Professor Leibig's work, and it had, indeed, been ascertained by Saussure, that germinating seeds absorb nitrogen, it was not supposed that it is derived from the atmosphere exclusively. And this has been deemed the chief discovery of the author, as far as practical questions are concerned."

"Hence in what form does nature furnish nitrogen to vegetable albumen, and gluten, to fruits and seeds? This question is susceptible of a very simple solution."

"The nitrogen of the air cannot be made to enter into combination with any element except oxygen, even by employment of the most powerful chemical means. We have not the slightest reason for believing that the nitrogen of the atmosphere takes part in the processes of assimilation of plants and animals; on the contrary, we know that many plants emit the nitrogen, which is absorbed by the roots, either in the gaseous form or in solution in water.—But there are numerous facts, showing that the formation in plants of substances containing nitrogen, such as gluten, takes place in proportion to the quantity of this element which is conveyed to their roots in the state of ammonia,* derived from the putrefaction of animal matter."—pp. 126, 127.

"Ammonia is the last product of the putrefaction of animal bodies; nitric acid is the product of the transformation of ammonia.

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*Ammonia is a compound gas, consisting of one volume of nitrogen and three volumes of hydrogen.

A generation of a thousand millions of men is renewed every thirty years; thousands of millions of animals cease to live, and are reproduced in a much shorter period. Where is the nitrogen which they contained during life? There is no question which can be answered with more positive certainty. All animal bodies during their decay, yield the nitrogen which they contain, to the atmosphere in the form of ammonia. Even in the bodies buried sixty feet under ground in the church-yard of the Eglise des Innocens, at Paris, all the nitrogen contained in the adipocine, was in the state of ammonia. Ammonia is the simplest of all the compounds of nitrogen; and hydrogen is the element for which nitrogen possesses the most powerful affinity."—pp. 129, 130.

Ammonia forms soluble salts with all the acids, and in combination with carbonic acid forms a volatile salt. It cannot, therefore, remain long in the gaseous form, as every shower of rain must dissolve and bring it to the earth. The quantity contained in a portion of atmospheric air of convenient size for analysis is so small that all attempts to detect its presence has failed, but from its extreme solubility, (water absorbing 780 times its bulk,) we may expect to find it in rain water.

"Experiments made in this laboratory, (Giessen,) with the greatest care and exactness, have placed the presence of ammonia in rain-water beyond all doubt. It has hitherto escaped observation, because no person thought of searching for it."—p. 132.

"The employment of animal manure in the cultivation of grain, and the vegetables which serve for fodder to cattle, is the most convincing proof that the nitrogen of vegetables is derived from ammonia. The quantity of gluten in wheat, rye and barley, is very different; these kinds of grain also, even when ripe, contain this compound of nitrogen in very different proportions. Prout found French wheat to contain 12.5 per cent. of gluten; Vogel found that the Bavarian contained 24 per cent.; Davy obtained 19 per cent. from winter and 21 from summer wheat; from Sicilian 21 and from Barbary wheat 19 per cent. The meal of Alsace wheat contains, according to Boussingault, 17.3 per cent. of gluten; that of wheat grown in the "Jardin des plantes" 26.7, and that of winter wheat 3.33 per cent. Such great differences must be owing to some cause, and this we find in the different methods of cultivation. An increase of animal manure gives rise not only to an increase in the number of seeds, but also to a most remarkable difference in the proportion of the gluten which they contain.

"Animal manure, as we shall afterwards show, acts only by the formation of ammonia. One hundred parts of wheat grown on a soil manured with cow-dung (a manure containing the smallest quantity of nitrogen,) afforded only 11.95 parts of gluten and 64.34 parts of amylin or starch; whilst the same quantity, grown on a soil manured with human urine, yielded the maximum of

gluten, viz. 35 . 1 per cert. Putrified urine contains nitrogen in the forms of carbonate, phosphate and lactate of ammonia, and in no other form than that of ammoniacal salts."—pp. 136, 137.

"The urine of men and of carniverous animals contains a large quantity of nitrogen, partly in the form of phosphates, partly as urea. Urea is converted during putrefaction into carbonate of ammonia, that is to say, it takes the form of the very salt which occurs in rain water. Human urine is the most powerful manure for all vegetables containing nitrogen; that of horses and horned cattle contains less of this element, but infinitely more than the solid excrements of these animals."—p. 138.

"The quantity of food, which animals take for their nourishments, diminishes or increases in the same proportion, as it contains more or less of the substances containing nitrogen. A horse may be kept alive by feeding it with potatoes, which contain a very small quantity of nitrogen; but life thus supported is a gradual starvation; the animal increases neither in size, nor strength, and sinks under every exertion. The quantity of rice which an Indian eats astonishes the European; but the fact, that rice contains less nitrogen than any other kind of grain, at once explains the circumstance."*—p. 139.

The effect of gypsum as manure, Liebig attributes to its power of decomposing the carbonote of ammonia and forming a fixed instead of a volatile salt.

"The evident influence of gypsum upon the growth of grasses, the striking fertility and luxuriance of a meadow upon which it is strewed, depends only upon its fixing in the soil the ammonia of the atmosphere, which would otherwise be volatilized with the water, which evaportes. The carbonate of ammonia contained in rain-water, is decomposed by gypsum, in precisely the same manner, as in the manufacture of sal-ammonia. Soluble sulphate of ammonia and carbonate of lime are formed; and this salt of ammonia possessing no volatility is consequently retained in the soil. All the gypsum gradually disappears, but its action upon the carbonate of ammonia continues as long as a trace of it exists.

"The beneficial influence of gypsum and of many other salts has been compared to that of aromatics, which increase the activity of

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*According to the analysis of Braconnet, this grain is thus constituted:

	Carolina Rice.	*Piedmont Rice.*
Water, - - - - -	5 . 00	7 . 00
Starch. - - - - -	85 . 07	83 . 80
Parenchima, - - - -	4 80	4 . 80
Gluten, - - - -	3 . 60	3 . 60
Unchrystallizable sugar, -	0 . 29	0 . 05
Gummy matter like starch,	0 . 71	0 . 10
Oil, - - - - -	0 . 13	0 . 25
Phosphate of Lime, - -	0 . 13	0 . 40

the human stomach and intestines and give a tone to the whole system. But plants contain no nerves; we know of no substance capable of exciting them to intoxication and madness, or of lulling them to sleep and repose. No substance can possibly cause their leaves to appropriate a greater quantity of carbon from the atmosphere, when the other constituents, which the seeds, roots and leaves, require for their growth, are wanting. The favorable action of small quantities of aromatics upon man, when mixed with his food, is undeniable, but aromatics are given to plants without food to be digested, and still they flourish with greater luxuriance."

"In order to form a conception of the effect of gypsum, it may be sufficient to observe that 100 Hessian lbs. of burned gypsum fixes as much ammonia in the soil as 6250 lbs. of horse's urine* would yield to it, even on the supposition that all the nitrogen of the urea and hippuric acid were absorbed by the plants without the smallest loss, in the form of carbonate of ammonia. If we admit with Boussingault, that the nitrogen in grass amounts to 1-100 of its weight, then every pound of nitrogen which we add, increases the produce of the meadow 100 lbs., and this increased produce of 100 lbs. is effected by the acid of a little more than four pounds of gypsum."

"Water is absolutely necessary to effect the decomposition of gypsum, on account of its difficult solubility, (1 part of gypsum requires 400 parts of water for solution), and also to assist in the absorption of the sulphate of ammonia by the plants; hence it happens that the influence of gypsum is not observable in dry fields and meadows. The decomposition of gypsum by carbonate of ammonia does not take place instantaneously; on the contrary, it proceeds very gradually, and this explains why the action of the gypsum lasts for several years."—pp 142, 143, 144.

"Now if we strew the floor of our stables, from time to time, with gypsum, they will lose all their offensive smell, and none of the ammonia which forms can be lost, but will be retained in a condition serviceable as manure."—p. 239.

This hint is well worthy the attention of planters. By doing it, they preserve the most valuable ingredient in compost manures, which would be otherwise dissipated in a great measure, particularly when heaps of compost are collected and allowed to ferment. Nearly the whole of the ammonia will escape before it is applied to the land. Gypsum probably acts also as one of the necessary

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* The urine of the horse contains, according to Foucrey and Vanquelin:

Urea, - - -	7 parts.
Hippurate of soda, -	24 "
Salt and water, - -	979 "
	1000

ingredients of some plants, as in clover and the cultivated grasses, in which its most wonderful effects are seen.

Sir Humphrey Davy says: "In examining the ashes of sainfoin, clover and rye-grass, I found that they afforded considerable quantities of gypsum; and this substance, probably, is intimately combined as a necessary part of their woody fibre."—*Agl. Chem* p. 317.

On the inorganic constituents of plants.—Besides the four elementary constituents of plants, there are other conditions necessary for their perfect developement. The metallic oxides always found in their ashes after incineration, prove them to be intended by an all-wise Creator to perform special functions in the lives of plants. Whether they are found in the juice which give flavour to the fruit, as the tartarate of potash in grapes, or as in the siliceous epidermis of many of the grasses and reeds, serving as a support and protection against insects, or whether as in the lichens, supplying, in combination with an organic acid, the place of woody fibre, their presence seems indispensable to the well being of the plant.

Their importance has not been properly appreciated, for soils generally contains enough under judicious and moderate culture, for the small quantity that a plant require; but when any particular crop continues to fail, or as it is said, becomes tired of the soil, although supplied with manure, it is probably owing to the want of the particular base necessary for the growth of that plant.

"Most plants, perhaps all of them, contain organic acids of very different composition and properties, all of which are in combination with bases, such as potash, soda, lime and magnesia. These bases evidently regulate the formation of the acids, for the diminution of the one is followed by the decrease of the other; thus, in the grape, for example, the quantity of potash contained in its juice is less, when it is ripe than when unripe; and the acids under the same circumstances, are fouud to vary in a similar manner."

"Phosphate of magnesia in combination with ammonia is an invariable constituent of the seeds of all kinds of grapes. It is contained in the outer horny husk, and is introduced into bread along with the flour and also into beer."—p. 148.

"Any of the alkaline may be substituted for another, the action of all being the same. Our conclusion is therefore, by no means endangered by the existence of a particular alkali in one plant, which may be absent in others of the same species. If this inference be correct, the absent alkali or earth must be supplied by one similar in its mode of action, or in other words, by an equivalent of another base. The number of equivalents of these various bases which may be combined with a certain portion of acid, must necessarily be the same, and therefore, the amount of oxygen contained in them must remain unchanged, under all circumstances, and on whatever soil they grew."

"Of course this argument refers only to those alkaline bases, which, in the form of organic salts, form constituents of the plants. Now these salts are preserved in the ashes of plants as carbonates, the quantity of which can be easily ascertained."—p. 150.

"When roots find their more appropriate bases in sufficient quantity, they will take up less of another."—p. 155.

"Let us compare two kinds of trees, the wood of which contains unequal quantities of alkaline bases, and we shall find that one of these grows luxuriantly in several soils, upon which the others are scarcely able to vegetate. For example, 10,000 parts of oak-wood yield 250 parts of ashes, the same quantity of fir-wood only 83, of linden-wood 500, of rye 440, and of the herb of the potato plant 1,500 parts.

"Firs and pines find a sufficient quantity of alkalies in granitic and barren sandy soils, in which oaks will not grow; and wheat thrives in soils favourable for the linden-tree, because the bases, which are necessary to bring it to complete maturity, exist there in sufficient quantity."

"All kinds of grapes, the Equisetaceæ, for example, contain in the outer part of their leaves and stalk, a large quantity of silicic acid and potash, in the form of acid silicate of potash.*—p. 158.

It is for this reason, says the author, that saline plants seek the sea-shore, and the grasses and seeds which furnish food for men, follow him like domestic animals, because they there find their appropriate alkaline bases. Phosphate of magnesia and ammonia are always found where men and animals dwell together.—p. 163. The author then mentions the peculiar property of some bodies, which under ordinary conditions remain fixed, of being volatilized and assuming the gaseous form, when dissolved in liquids which are undergoing evaporation. And "thus by the continual evaporation of the sea, its salts† are spread over the whole surface of the earth; and being subsequently carried down by the rain, furnish to the vegetation those salts necessary to its existence. This is the origin of the salts found in the ashes of plants, in those cases where the soil could not have yielded them"—p. 166.

It will readily be perceived by the foregoing extracts, that Liebig considers the presence of alkaline bases in the soil as of great

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* A species of the aster which grows on dry sandy soils in the lower part of our State, contains so much of this substance, that it may be distinctly seen with a magnifying glass, forming a glassy nett-work over the surface of the leaves. The leaves may be used in the place of fine sand paper for polishing horns, &c.

† According to Marcet, sea-water contains in 1,000 parts,

Chloride of Sodium,	26 . 660
Sulphate of Soda,	4 . 660
Chloride of Potassium,	1 . 232
Chloride of Magnesium,	5 . 152
Sulphate of Lime,	1 . 5

importance. Without their presence, plants, although supplied bountifully with other nutrition, cannot attain perfection. He mentions the example of a farmer near Gottingen, who rendered his land incapable of producing grain for many years, from having planted it in worm-wood, which exhausted the soil of its potash. Indeed, it would appear that the chief effect of the solid excrements of animals, is in their furnishing to the soil a large portion of inorganic bases.

In the analysis of horse-dung by Dr. Jackson, 500 grains being heated a little above the temperature of boiling water, lost 357 grains water. The residue, 143 grains, when burnt, left 8 grains of ashes, consisting of silex, phosphate of lime, carbonate of lime and phosphate of magnesia and soda. Nearly 3-4 by weight consisted of water. Of the residue, after deducting 8 grains, the weight of the salts, 135 grains consisted principally of vegetable fibre and a small portion of animal matter, too insignificant entirely to account for its effect on plants.

This subject deserves further investigation. If, as Dr. Dana states, the ashes of cotton contain 17 per cent. of the phosphates of lime and magnesia, what immense quantities of these salts do we annually take from the soil?

It is verv well known that green seed cotton flourishes in rich bottom lands, where the black seed scarcely produces any thing, and the fine cottons of the sea islands deteriorate, when removed beyond the influence of the sea. May these differences not be satisfactorily accounted for, by careful analysis of the different specimens.

It is obvious that when the constituents of plants are accurately ascertained, and also the ingredients of the soil in which they are to grow, every farmer can go more understandingly to work in applying the proper remedy for any defect that may exist.

AN ESSAY ON MAKING COMPOST HEAPS FROM LIQUIDS AND OTHER SUBSTANCES, WRITTEN ON THE EVIDENCE OF MANY YEARS EXPERIENCE—TO WHICH THE PRIZE OF TEN SOVEREIGNS WAS AWARDED.

BY JAMES DIXON, ESQ., SECRETARY TO THE MANCHESTER AGRICULTURAL SOCIETY.

THE force and power of an agriculturist to produce good crops mainly depends on the manures he can command; and how to derive the greatest possible benefits from his immediate resources is one of the most useful subjects that can engage his attention. The English Agricultural Society having offered a premium for the best mode of making compost heaps, I venture to forward the

committee my ideas on this most important branch of rural management; and in doing this I shall state the course I have pursued in this particular for many years, and in which every additional experience inclines me not to make any systematic alteration.

My farm is a strong, retentive soil, on a substratum of ferruginous clay; and being many times disappointed in what I considered seasonable anticipations of good crops, I determined on a new system of manuring. Though quite satisfied of the expense which would necessarily be incurred by my plan, I still determined on its adoptiou. At the onset I effectually drained a considerable part of my farm. My next object was how to improve its texture at the least cost—(perhaps I may be allowed to state that my holding has always been at rack-rent); for this purpose we carted great quantities of fine sawdust and peat earth or bog; we had so far to go for the latter, that two horses would fetch little more than three tons in one day—one horse would fetch three cart-loads of saw-dust in the same time. Having brought great quantities of both peat and sawdust into my farm yard, I laid out for the bottom of a compost heap a space of considerable dimensions, and about three feet in depth: three fourths of this bottom was peat, the rest sawdust: on this we conveyed daily the dung from the cattle shed, the urine also is conducted through channels to wells for its reception—one of each side of the compost heap;—common water is entirely prevented from mixing with it. Every second day the urine so collected is thrown over the whole mass with a scoop, and at the same time we regulate the accumulated dung. This being continued for a week, another layer, nine inches or a foot thick, of peat and sawdust (and frequently peat without sawdust) is wheeled on the accumulated heap. These matters are continuously added to each other during winter, and in addition once in every week never less than 25 cwt., more frequently 50 cwt., of night soil and urine; the latter are always laid next above the peat or bog earth, as we think it accelerates their decomposition. It is perhaps proper here to state that the peat is dug and exposed to the alternations of the weather for several months before it is brought to the heap for admixture; by this it loses much of its moisture. In some cases, peat contains acid or astringent matters, which are injurious to useful vegetation. On this I have not tried any decided experiment, but am led to the supposition by frequently seeing stones, some in a partial state of decomposition, others wholly decomposed in bogs, and at the depth of several feet from the surface. Some years' experience has convinced me of the impropriety of using recently dug peat; proceeding in the manner I recommend, it is superior and more convenient on every account—very much lighter to cart to the farm-yard or any other situation where it is wanted; and so convinced am I of its utility in composts for every description of soil, except that of its own character, that wherever it can

be laid down on a farm at less than 4s. per ton, I should recommend every agriculturist and horticulturist that can command it, even at the cost here stated, to give it a fair trial. So retentive and attractive of moisture is peat, that if liberally applied to any arid, sandy soil, that soil does not burn in a dry season, and it so much improves the texture and increases the produce of an obdurate clay soil, if in other respects rightly cultivated, that actual experience alone can fairly determine its value.

For the conveyance of night-soil and urine, we have the largest and strongest casks, such as oils are imported in; the top of which is provided with a funnel to put the matters through, and the casks are fixed on wheels like those of a common dung-cart. For the convenience of emptying this carriage, the compost heaps are always lower at one end; the highest is where we discharge the contents, in order that they may in some degree spread themselves over the whole accumulation: the situation on which the wheels of these carriages stand while being discharged is raised considerably; this we find convenient, as the compost heap may be sloped six or seven feet high: low compost heaps, in my opinion, should be avoided. The plan here recommended I have carried on for some time. I find no difficulty in manuring my farm over once in two years; by this repetition I keep up the fertility of my land, and it never requires more than a moderate application of manure.

I am fully aware that there are many localities where neither peat nor night-soil can be readily obtained; but it is worth a farmer's while to go even more than twenty miles for the latter substance, provided he can have it without deterioration: the original cost is often trifling. On a farm where turnips or mangold are cultivated to some extent, the system here recommended will be almost incalculably advantageous; a single horse is sufficient for one carriage—mine hold upwards of a ton each; six tons of this manure in compost with peat, or, if that is not convenient, any other matters, such as a ditch scourings, or high headlands which have been properly prepared and laid dry in a heap for some time, would be amply sufficient for an acre of turnips or mangold. This manure is by far the most invigorating of any I have ever yet tried; bones in any state will bear no comparison with it for any crop; but it must be remembered that I write on the supposition that it has not been reduced in strength before it is fetched.

Convenience frequently suggests that compost heaps should be raised on different parts of a farm; but, unless in particular instances, it is well to have them in the yard: in the farm-yard, all the urine from the cattle stalls may be employed with the greatest economy; and be it remarked that the urine from animals, in given weights, is more powerful than their solid excrements.* How

* This must be taken with some limitations, for urine contains 90 to 95 per cent. of water; and unmixed dung contains all the salts of urine, besides much mucus and other substances.—W. L. Rham.

important then must it be to the farmer to make the most extensive and the most careful use of this liquid. It is sometimes carted on the land, but that practice will not bear a comparison with making it into composts in the manner here recommended. Great waste is often made in putrescent manures after they are carted on the land; instead of being immediately covered or incorporated with the soil, we not unfrequently see them exposed for days together in the hot rays of a scorching sun, or to the injurious influences of a dry wind. I have before stated that compost heaps should on many considerations be raised in the farm-yard; still circumstances are frequently such that it is more proper to make them at some distance in the fields. If a headland becomes too high by frequent ploughings or working of the land, in that case it should be ploughed at the time when clover or mixed grass seeds are sown with a white crop, for instance, barley or oats, and clover for the year following: a headland might then be ploughed, and a number of cart-loads of some manure heaped from one end to the other. Immediately after this it should be trenched with the spade (or what is sometimes called digging,) and ridged high, in order that an action should take place between the soil and manure; by this means the mass would soon be in a condition for turning over, and any ditch scourings, or other matters which had not in the first instance been used, might now be added to the mixture. The heap should then be allowed to remain closed for a few weeks, then turned over again; at this turning, in all probability, the mass would be much reduced; if sufficiently reduced, raise the ridge of compost well on both sides, but, instead of its top being pointed, make a trench or cavity on the top from one end of the heap to the other. This cavity should be made tolerably retentive of moisture, which may be effected by treading with the feet; carriages of night soil or urine from the cattle stalls may then be emptied into the trench, and the bulk of the heap would determine how many were required; this being done, a little earth should be thrown into the trench, and the heap allowed to remain in that state until the middle or latter end of autumn; it will then be ready for another turning; but at this time care must be taken to have the heap well made up at the sides and pointed at the top; in this situation rain will be thrown off, and the compost preserved dry until winter presents some favorable opportunity for laying it on the young clover, wheat, or for making any other use of it which may be required.

The beneficial effects of top-dressing young clovers or mixed grass seeds is scarcely ever regarded with due attention. By this help crops are not only much increased, even 30 or 50 per cent., but they are also ready for cutting much sooner, which in a backward spring gives the stock farmer inestimable advantages for sorting his cattle, and thereby raising manure at his pleasure. The full effects of this practice I first experienced in the dry season of

1826: I had some clovers which had been manured the previous winter; my land was soon covered with crop, and that so vigorous a one, that the hot weather did not overpower it. My cows that summer were tied up during the day time, and in the night they were turned out into the pastures; most of the stock in my district were much distressed from over-heat as well as from being short of food for some weeks; milk yielded little butter, scarcely any for a time was offered in our large market town:—no doubt that year will be remembered by many gentlemen on the Agricultural Society's committee. I, however, was under no difficulties on account of the season: my clovers produced plenty of food for my cattle, and in return they yielded as much milk and butter as I ever recollect from the same number. I am persuaded that the same satisfactory results would have followed if the same system had been adopted for feeding stock; it was that year my attention was first directed to raising compost heaps from urine. This I now do frequently without the help of any dung from the cattle-stalls; the same occasion called my mind to another matter well worthy every farmer's attention—I allude to the great superiority of the manure raised in summer-stalling to that produced in the stalls during winter. I verily believe the difference is fifty per cent. unless stock are fed in a great measure during winter with artificial food. In an arrangement for making compost heaps from urine, I would recommend a receptacle to be made at the back of the cattle stalls just outside the building; this should hold about 20 cartloads of mould, or any other matters to be employed; if its situation were a little lower than the cattle-sheds all the urine would pass into it, and remain there until the mass is completely saturated, which will be sufficient; when the earthly matters are covered over with it, the compost may then be thrown out and the proceeding again renewed. In order to show part of the benefits of this practice, I beg here to observe that the most foul or weedy mould may be used; the action of the urine, if not reduced by water, is so powerful, that wire-worms, the black slug, many other destroying insects, and all vegetables, weeds, &c., when in contact with the urine for a time are deprived of their living functions. The situation for raising this compost should be protected from the weather by a covering similar to a cart-shed; indeed, the deteriorating influences of rain, sun, and arid winds, on all putrescent matters or compost are so serious, that in my humble judgment it would be worth while to have places under cover where these are usually laid down.

I beg to conclude this essay with some observations made on a former occasion: No amelioration connected with the rural art is of more lasting importance than correcting the constitutional defects of a soil. The best horticulturists and market-gardeners are many of them perhaps, unacquainted with the theory, yet perfectly understand the great results from that practice; and in this

particular information they are all of them superior to many practical farmers. How often do we see a stiff soil sterile in a great degree from that cause only; yet in the vicinity of a sandpit and adjoining most bogs there is a considerable breadth of coherent land, which might be made double its present value by judicious and liberal top-dressings of peat, which is also unproductive from causes of a contrary nature. The present poverty of many extensive tracts of land is a manifest exhibition of the want of skill or enterprise of their owners and cultivators.

[*From the Journal of the English Agricultural Society.*

AN IMPORTANT DISCOVERY IN AGRICULTURE.

In the Phalange, a Fourier paper published at Paris, of Sept. 8th, a novel discovery is described, which if true, will work a great change in an important department of agricultural labor. It is communicated to the Paris print by Charles Polliard and M. Bernard who dated their letters at Brest, August, 1841. It appears that while they and some of their friends, who farm their own estates, were engaged in conversation on the subject of agriculture, it was observed by one of them, that that branch of industry was suffering more from the want of capital and enterprise than any other, and that nothing was to be done without manure, which was every day becoming more scarce and expensive. This remark led to an inquiry into the properties of manure, and particularly as to what provision nature had made in those uncultivated regions where there seems to be a vigorous and luxuriant growth, without artificial assistance.

"In observing nature unassisted, or unthwarted, by the hand of man, in vegetable reproduction, it is found that when the seed is ripe it falls upon the ground, and then the plant which has produced it sheds its leaves, or falls itself upon it, in decay, and covers and protects it from the weather, until germination has commenced, and the young plant is able to grow up in health and strength, and full developement, to recommence the same routine of seeding and of reproduction.

"From this it follows that, in nature, every plant produces its own soil or *humus*, and that the earth only serves to bear the plant, and not to aid or nourish it in vegetation. The nourishment of plants is thus supposed to be derived from *air* and *water*, *heat* and *light*, or electricity—in different proportions, adapted to the different varieties of vegetable nature."

With this general notion in their minds, and considering wheat to be, in present circumstances, one of the most important vegetable substances, they agreed to try experiments, and in October of last year undertook the following operations:

In a field which had been sown with rye because the land was deemed too poor for wheat, a plat of twelve square yards, untilled and left without manure, was carefully strewed over with the grains of wheat, and wheaten straw was laid upon it closely, and about one inch in thickness. In a garden, also, which had been neglected several years, a few square yards of earth were trodden over, and the surface being made close and hard, some grains of wheat were scattered on this hardened surface, and a layer of straw one inch in depth, was carefully laid over it and left as in the former case, to take its chance without ulterior attention. And in order to make doubt impossible concerning the mere secondary functions of mineral earth in vegetable reproduction, twenty grains of wheat were sown upon the surface of a pane of glass and covered with some straw alone, as in the other case.

The germination of the seed was soon apparent, and most healthy in developement. "The winter has been rigorous," say these correspondents, "for this part of the country, and the earth has sometimes been frozen in one solid mass to the depth of six inches in the garden where the wheat was sown, and this has happened several times during the winter, to the great injury of many plants, and even the entire destruction of some, while the spots protected by the straw, were never thouroughly congealed, nor were the grains of wheat, though lying on the surface under the straw, at all affected by the cold. During the spring, excessive droughts, prolonged, and several times repeated, have prevented vegetation on the common plan from flourishing in healthy progress, while our little spots of wheat have hardly felt the inconvenience of excessive dryness, for the earth, protected by the straw, has never been deprived entirely of moisture, and our blades of corn (wheat) were flourishing, when all around was drooping and uncertain. To conclude, then, we have thoroughly succeeded in our practical experiment, and the wheat produced is of the finest quality. The straw was more than six feet high, and in the ears were 50, 60, and even 80 grains of wheat of full developement—the admiration of all who saw them, and particularly those which grew upon the pane of of glass, and which were quite as healthy and as large as those which grew upon the common earth. It must be observed also, that there was not the smallest particle of earth upon the glass, and that the plants were left entirely to themselves, without being watered or attended to in any way whatever from the time of sowing to the time of reaping."

The cause of this success, they think, may be explained in the following manner:

"Straw being a bad conductor of heat, and a good conductor of electricity, maintains the root of the plant in a medium temperature, and prevents the earth from being deprived entirely of moisture. The moisture of the earth or the substratum, being

continual, facilitates the gradual and constant absorption of carbonic acid gas from the surrounding atmosphere, and hydrogen and carbon, the chief elements of nourishment to vegetables, are thus economised in regular supplies where they are constantly required, and pass in combination with oxygen from the roots up to the stem and branches of the plants in which they are assimilated, and the oxygen throws off in exhalation from the leaves. The straw decays but slowly, and thus furnishes its substance by degrees to the young plant in due progression and proportion, (such as the siliquous ingredients, for instance, of the pod or capsule,) so that the decomposition of the straw corresponds to the four phases of fermentation, in progressing from the *saccharine* to the *alcolic*, the *acid* and the *putrid* states, analogous to those of *infancy*, *budding*, *youth*, and *seeding* of the plant.

"We observe that our blades of wheat have but a very few roots, and those are short and hard, something like a bird's claw, and this agrees with the remarks of Mons. Raspail, who states that the most healthy plants in ordinary vegetation have the least exuberance of roots and fibres.

"Another important observation, also, is that weeds and parasitical vegetation, are prevented by this method, for the straw chokes every other plant but that of its own seed. Many other interesting observations might be made on these experiments, but we refrain at present from obtruding on your readers; but if any of them wish for furthuer information on this subject, we shall willingly afford them every facility. The importance of the general result will easily become apparent without further comment, and a revolution in the present modes of agricultural labor is a necessary consequence of this discovery. No tillage will now be required nor any artificial stimulants in manure and other more or less expensive combinations with regard to soil and culture. In fact, it would be tedious to enumerate the various advantages that may result in practice from this casual experiment, and therefore we proclaim it simply to the world, that all may profit by it."

As this experiment can be easily tried, we hope some of our farmers will put it to the test and communicate the results. We shall certainly try it on a small seven by nine lot of ground, which is the largest that is vouchsafed to a dweller in the city.

[*N. Y. Eve. Post.*

SUBSOIL CULTIVATION.

Mr. Editor,—I am an old man, and an old farmer; but my eyes are not so dim, but I can see there is much to learn in the way of a profession that has hitherto been considered either too high or too low—*which* I cannot say—to admit of much advantage from observation or reflection; indeed it is plain that we shall be distanced in the race of improvements that is taking place around us in

farming, as well as in any other science. But the subject that has awakened me to new life and fresh vigour, even in my old age, is, the cultivation of the subsoil, by means of moving it by such an instrument as that of which you have given us a drawing in your last, the Deanston Plough; and for the first time in my life, I regret that I was born so soon, by 20 years. Why, Mr. Editor, I can see with half an eye that the thing will work, and can fully understand how that the operation must be beneficial for a sandy, as for a clay soil, much of the former, as well as of the latter, having a retentive subsoil, which operates in a twofold way to the injury of the crop, first, in wet weather, as preventing a glut of water from passing away, until it has become putrid and poisonous to vegetation, and, next, in a time of drought, preventing the descent of the roots of the plants in search of moisture, which is ever present, even in the driest seasons, within a given distance of the surface of the earth, and where, as you say, they go for water, which by their tap roots is *pumped up* to the lateral roots, while busily engaged in search of food in the surface soil—a pretty idea that, and worth many times the subscription money of the Cabinet.

To a want of deep ploughing might be attributed, I have no doubt, the weakness of our wheat-crops, which are so liable to be prostrated by any little gust of wind, after it has shot into the ear, and often, indeed, before that period. With a strength, equal in appearance to any vicissitude of climate, we find our crops ready to fall by their own weight, and wonder that with straw oftentimes like reed, they have the substance only of the common grasses. This is the cause, depend upon it, and it is but natural that it should be so, for I have long considered the tap-root of a plant—and which even wheat is furnished with—to act the part of an anchor, and the lower and deeper this is cast, the greater will be the power of resistance; while the secondary purpose which it serves, that of "pumping from below the moisture that is to serve as drink, to the food which is collected by the lateral roots in the surface soil," is new to me, and finishes the picture admirably. I consider therefore, the operation of sub-soil ploughing the "ne plus ultra," as the blacking makers say—of successful agriculture, and have great hope that by its adoption, one-half, at least, of the evils attending the cultivation of the wheat crop will be obviated, possibly the blight and rust, and even the Hessian fly, and especially *the lifting of the crop by frost.* [*Farmer's Cabinet.*

ON THE CULTIVATION OF LOW LANDS.

As soon as haying is over we must think of preparing our bog meadows and other low lands for English mowing—Ditching is the first step in the process, and all low grounds which can be drained can be made to produce good English hay. Ditches should run parallel with each other whenever the ground will admit of it,

because we may hereafter wish to introduce the plough when the soil needs again to be inverted, and it is surprising to see how soon the most miry meadow can be made to bear up a team, when the roots of the cultivated grasses have taken the place of the natural growth.

Mode of digging Ditches.—We usually choose to dig our ditches about three feet wide at the top, but they need not be so much as one foot wide at the bottom; and the sides should always be sloped at an angle of forty-five degrees, giving them about the same pitch as the roof of a modern barn. By forming them in this shape, the cultivated grasses will cover the slope instead of a border of wild grass, and the bank of the ditch will stand firm instead of sliding down as a steep one will to fill up the water channel.

In digging a ditch it is found most convenient to lay all the surface cuts on one side and the loose muck on the other, that the sods may sooner become dry for burning and that the muck or matter dug from the bottom may be more easily shovelled into a cart or spread upon the ground. Should the weather be dry these surface sods may be burned before the month is out, and they will often burn better in three or four weeks after digging than when they have lain a whole year. In a dry summer, therefore, we are able to spread the loose muck, cover it with loam or with gravel, and apply to the surface all the ashes from the sods ready to be buried with the herd grass and the red-top seed. By this management we may often convert an acre of bog meadow to the best of English mowing in a single month; but when a bog is quite wet and the surface will not bear a cart or a wheel-barrow it is advisable to dig the ditches in one season and to sow the grass seed in the following.

Lands are so differently situated and the nature of the bottoms are so various, that no single rule will apply to all bog meadows. When the soil will bear up a team it may be cheapest to use a cart; but when the loam and gravel which is to be laid on is within a half a dozen rods of the meadow, two men with barrows will cover over a greater extent of surface than one man will with a yoke of oxen; and when the surface is not very uneven *and the meadow grass has been left uncut,* two men with barrows will cover one acre completely in a week so as to destroy or turn to manure the whole vegetable growth.

Expense of fitting one acre for Grass.—We see a vast many of bog meadows, now totally unproductive, which are so situated that two men in one week can cover the whole surface; and the expense of course cannot exceed twelve dollars. The ditching can be done for twenty-five cents per rod, and as each acre will not require more than twelve rods of ditch, this charge will not exceed three dollars. Manure is then to be spread on the surface; and as not half so much will be required as in a dressing for corn, we will estimate the cost at twelve dollars, making the whole cost twenty-

seven dollars. Thus an acre of worthless bog meadow may be completely fitted for the reception of English grass seed at an expense of twenty-seven dollars; and we will add one peck of herdsgrass and two or three pecks of red top—say two dollars;—and this must be sown and raked in—count it one dollar. Now we have run the expenses on one acre up to thirty dollars; and you will say that you can buy land enough, ready made, for less money than thirty dollars—true, but what will the produce of this acre be worth for three years to come?

If the work has been well done you may calculate on six tons of merchantable hay from this acre in the three next years; and as hay within thirty miles of this city has averaged not less than fifteen dollars per ton,—six times fifteen are ninety dollars. Or the first crop will cover the whole expense save that of harvesting; and as this will not exceed six dollars for the first year, your whole outgo after selling this first crop will be $6, or the expense of harvesting it; and your whole gain in the three years will be ninety dollars, minus thirty, added to eighteen—or minus forty-eight. You have gained then forty-two dollars on this single acre in the harvests alone! But what have you gained in the land? Such land, thus brought to its bearing, is worth two hundred dollars per acre; and it has often been sold for as much to be kept in mowing.

We are aware that some will say this land will not continue to produce such burthens. No, if it would, it would yield twenty-four dollars per year besides the expense of haying, and this would pay the interest of four hundred dollars instead of two. Now let the owner expend judiciously twelve dollars annually for a top-dressing, and his crops will be likely to increase rather than diminish; and he may have his twelve dollars for the nett annual income of his acre of mowing land.

We profess to know what we are talking of, and we appeal to any experienced farmer to say whether an acre of land which yields *one ton* annnally does not yield a nett income of twelve dollars. The truth is we have but a few acres which will yield so much without the expense of dressing: but we have a vast many acres which will yield twice as much if we will appropriate twelve dollars annually to keep them in good order.

Thus we may see by a judicious outlay of thirty dollars on an acre we may in many places raise the value of that acre to two hundred dollars, though its usual product was not worth one dollar a year. If any timid farmer fears that such profits will lead his family into extravagant habits he should make trial of only half an acre in a season; very few farmers would be ruined by such an experiment as an outlay of fifteen dollars on a half acre of land.

[*Boston Cultivator.*

ARTIFICIAL WATERING PLACES.

If the following plan of obtaining watering places be predicated in just principles of natural philosophy, and is true in point of fact, the suggestion may be of great value, especially in a dry time, when the springs and streams on farms fail to supply water for stock. It seems to us incredible that a bar el sunk in a dry soil, where the earth is not springy, should collect any water at all, and equally incredible that filling up the barrel with pebbles should cause the water to rise above them. But the writer speaks with a confidence in his principles, and in his *fact* as demonstrated by actual trial. We give the plan as it comes to us. Our readers may like to see it. If found successful, the public should know it. The article is copied from the *Albany Cultivator*, a most respectable Agricultural Journal. The theoretical explanation or conjecture, at the close of the article, advanced to account for the alleged fact, has something to do with philosophical principles.

[*Editor of Maine Cnltivator.*

Messrs. Editors of the Cultivator,—Mr. William Robertson of Fishkill Landing, Dutchess County, one of our most successful farmers, has communicated to me the following mode, successfully practised by himself, of supplying with water, fields destitute of springs, ponds or rivulets. The farm lately occupied by him is now in the hands of its proprietor, J. D. L. Verplank, Esq., where the watering places constructed by Mr. R. may still be seen. The situation of the farm is upon the whole favorable for the purpose, and the plan therefore may seem to require further tests by experiment, before it can be considered invariably successful. He says it was an entirely accidental discovery; he one morning found one of his calves drowned in a barrel sunk in the usual way for the purpose of collecting water from a spring. The water had sunk to near the bottom of the barrel, and the animal in reaching down for it had lost its balance, and falling, was unable to extricate itself. Vexed at his loss, he immediately ordered the cavity to be filled up; this was accordingly done by throwing in a parcel of round pebble stones, which were lying near at hand. The next day in passing by, he saw to his surprise, that the water had risen over the tops of the stones, although no rain had fallen, and the season had been very dry.

The idea then struck him (manifestly erroneous, as the barrel is not water tight in these cases) that it was similar to the raising of water in a pitcher by throwing in pebbles, and he determined to make the experiment more complete. Accordingly the barrel was taken out and the hole deepened with very little appearance of water, and he struck his crow-bar down so as to make several deep holes, he then replaced the barrel, packing it well arouud with

earth, and afterwards filled in the barrel as before with the pebbles. In a short time he had the pleasure to find the water oozing in and gradually rising over the stones until it stood permanently some inches over the surrounding level. He repeated the trial in several other fields, and always with success, even in places where, on first digging down, there was not the least appearance of moisture, much less of water; he considered that the appearance of springiness is of no consequence, but the water will at length show itself in the barrel in all cases, and will finally rise eighteen or twenty inches above the surface, apparently increasing in quantity for a year or two.

Such is Mr. Robinson's statement; and he is fully entitled to our confidence, yet I do not believe that this is an infallible method of obtaining water in every situation, strata or soil; it nevertheless appears to me reasonable to suppose that it may prove of great service in many places at present destitute of water, without resorting to expensive boring, digging wells or making artificial ponds; the last especially from the severity of our seasons, requiring great labor and care in their construction to prevent their being affected by frosts or drought.

I do not know whether the following suggestions will throw any light on the rationale of this simple process, which at first sight appears scarcely entitled to notice. The driest soil (to appearance completely dessicated) nevertheless contains some moisture, quickly attracts more from the atmosphere, and, if collected, from a large body of earth, it would form a considerable rill. If we suppose one drop gradually to distil and roll over into the excavation, its fall and its attraction will put in motion the next particle and the next; and so on as long as there are particles to be affected, and this takes place not only in one right line, but extends in every direction: at first only those flow towards the aperture which are in a horizontal plane with the upper level of the vessel, but by degrees the higher strata are affected, and their pressure from above in a tight vessel or tube (for the sides of the barrel become tight by the pressure and packing of the earth and the swelling of the staves with moisture) is at length sufficient to force up and sustain a column of water something above the surface of the adjacent soil. I presume were the communication to be cut off by any means with lands, though distant, higher than the surface of the ground around the barrels, it would not rise above the rim.—Probably with a neater adjustment and a perfectly water tight apparatus, a still greater elevation might be obtained. The origin of natural springs is accounted for in precisely the same way; the only difference is that we furnish an artificial reservoir for the almost imperceptible arteries of the earth, which otherwise would steal away to some natural orifice issuing at the surface. The stones

assist in enabling a small quantity of water to rise to a higher level; perhaps their natural coldness aids in condensing terrestial vapor.

It may be considered analogous to the creating an issue in our own flesh by inserting a pea, for instance, in a muscular part of the body, and thus creating a dissemination of the natural lymph to one particular office. I should have made trial of this plan on my own place, but (fortunately in all other respects) mine is a piece of ground abounding in water and would add no corroboration therefore to the experiments of the inventor; requiring so little trouble, perhaps some of your contributors will put it into execution, and communicate the result. A Subscriber.

CORN-STALK SUGAR.

From a Letter addressed to Dr. J. W. Thompson, President of the New Castle County (Del.) Agricultural Society:

"Having been requested to furnish some account of the process for manufacturing sugar from corn, I cheerfully comply in giving all the information on the subject so far as I am at present acquainted with it. Scarcely one year has passed since the first idea was suggested in relation to this peculiar plan for making sugar; and there has not been sufficient time for those exact experiments necessary to satisfy the careful calculator. In one case I obtained from a small piece of ground, at the rate of 100 pounds of sugar per acre, but other experiments made since, have conclusively shown, that had a different mode of planting been adopted, the product would have been increased tenfold. The manner of raising the corn and making the sugar is as follows:

The corn is planted in rows 2½ feet apart, and the stalks are left to stand in the row 3 inches one from another; it is then cultivated in the usual manner. Sometime in August, or as soon as the stalks shows a disposition to form grain, the ears must be taken off; this operation must be carefully attended to, as upon it entirely depends success. After this there is nothing more to do until the crop is ready to be taken up, which will generally happen in September; the stalks are then cut up at the root, stripped of their leaves, and taken to the mill, where the juice is pressed out between iron rollers, in the same way usually employed with the sugar cane. Lime water about the consistency of thin cream, is then mixed with the juice, one spoonful to the gallon; it is left to settle one hour, and then poured into boilers, which are covered until the liquid approaches nearly to the boiling point, when the scum must be taken off. It is then boiled down as rapidly as possible, taking off the scum as it rises. As the juice approaches the state of syrup, it is necessary to slacken the fire to avoid burning. The boiling is generally completed when six quarts are reduced to one: it is then poured into coolers or

moulds and set aside to chrystalize. When this process is gone through, the sugar is to be separated from the molasses; and the whole operation is finished. The process here detailed gives the quality of sugar you see in the samples. If required, it can be afterwards refined as other sugar. The use of animal charcoal and the employment of steam in the process of evaporation, as is common in the manufacture of beet sugar, would, I am confident, produce white sugar at one operation.

From what is known on the subject, I fully believe that an acre of good ground treated as above described, will yield at least 1000 pounds of sugar—probably more. The value of the fodder taken from the stalks, and of the stalks themselves after passing through the mill, will be more than equivalent for the whole expense of cultivation and keeping the ground up. The fodder produced in this way is much superior to that usually made, from its containing a greater quantity of saccharine matter. And the whole business of making sugar from corn contrasts so favorably with the manufacture from beets, that I cannot but think it will obtain the preference wherever the climate will bring the former plant to perfection. Some of the differences may be enumerated as follows: 1st, the corn is clean and agreeable to work with, while the beet is not. 2d, the machinery for extracting the juice from beets is not only more costly, but is more liable to get out of repair. 3d, the beet juice contains a much greater proportion of foreign and injurious matter, decomposition commences almost immediately after it is pressed out, and if allowed to go on to any extent, will entirely defeat the making of sugar. 4th, the proportion of saccharine matter contained in equal quantities of corn and beet juice, is as 3 to 1 in favor of the former—therefore the same difference will be found in the amount of fuel necessary in evaporation. 5th, beet sugar, when obtained, is inferior in quality and loses a larger per cent. in refining. 6th, corn is a native of our country, perfectly suited to the climate, a true American, and is in fact, the finest plant in the world. The author of "Arator," (Col. Taylor, of Virginia,) used to call it our "meal, meat and manure." We now add *sugar* to the list of its valuable productions.

Respectfully yours,

William Webb.

Upon this communication Mr. Pedder, the editor of the Farmer's Cabinet, remarks—

"I am free to confess that I have never seen beet sugar prepared by first process at all equal to the samples of corn-stalk sugar forwarded by Dr. Thompson, while the molasses, which by the bye, contains more than 50 per cent. of sugar, is far superior to that made from the beet by *any* process: indeed I have never known beet molasses pure enough for any purpose but distillation or the

feeding of stock, for which last, however, it is of very great importance. Mr. Webb has the merit of deciding the question, "Can good sugar be made from the corn stalk?" Whether it can be made to *profit*, is a second consideration, which he will have it in his power to determine. The simple mode of operation which he details, would do but little in the fabrication of sugar from the beet; for while there is not the least difficulty in the process by well-appointed machinery, it is readily admitted that a considerable portion of art is requisite in the numerous stages of the fabrication of beet sugar, to free it from the impurities found in the root. With improved apparatus and experience in the present art of refining, there is no question that loaf sugar might be made by first process from the corn-stalk.

Mr. Webb's modest and unreserved account of the mode of manufacture will be read with very great interest, for if the corn-grower can be directed to a new channel for the consumption of half his crop, in the fabrication of an article of such legitimate usefulness, the gain to the community will be of incalculable importance." [*Farmer's Cabinet.*

PAPER NETS FOR CLEANING AND VENTILATING SILK-WORMS.

Messrs. Gales & Seaton,—Believing the above named admirable labor-saving and ventilating apparatus to be the most valuable invention for that purpose that has been made since this noble insect was first domesticated, I should deem myself guilty of inexcusable neglect if I failed to urge its adoption on American silk culturists. Before I describe the paper nets, the method of making them, and the manner of using them, I will quote a passage from a letter of Dr. J. S. Bell, (Journal of the American Silk Society, Volume II., page 360,) which will show the opinion entertained of their value by intelligent silk culturists in France. I am now using two hundred and fifty paper nets; and, after several weeks' close observation, I believe them to be worthy of all the praise that has been bestowed on them in France. Persons unacquainted with the habits of silk worms are incompetent judges of the value of fixtures designed for their accommodation: hence thousands of dollars have been expended by inexperienced theorists in the United States for the purchase of fixtures, that have subsequently been thrown away. The capital expended in this way, since 1825, would furnish an ample bounty for the establishment of this valuable culture in three or four States of the Union. Speculators are still at work, and there is reason to fear that larger sums will yet be thrown away for unsuitable fixtures.

"It is well known that a speedy and effectual method of clearing away the litter from the worms, during the feeding process, has long been a desideratum. The network hurdies were recom-

mended for this purpose; but their inefficiency is now, I believe, universally acknowledged. It appears, from the pages of the 'Propagateur,' that the operation of cleaning of the worms is now performed, in all the principal French colonies, by means of what are termed paper nets, (papiers fillets.) It appears that nets made of twine were first used: but they are now universally superseded by these paper nets, which are much cheaper, and are said to be better adapted to the purpose. I regret that I have not been able to find any description of these nets in the 'Propagateur;" all the communications take it for granted that the reader is already acquainted with their construction. As far as I can discover, however, from the different articles on the subject, I think they are made by punching a grest number of small holes in a strong paper, with an instrument constructed for the purpose. When this paper is laid upon the worms to be cleaned, mulberry leaves having been previously sprinkled over it, the worms ascend through the holes as they are said to ascend through the meshes of the network hurdles, and the paper underneath containing the litter can of course be removed. The inventor of this apparatus is M. Eugene Robert. In a letter to the editor of the 'Propagateur' he remarks: 'The use of the paper nets in the economy of Saint Tulle, and in a great number of large and small establishments in the neighborhood, has been attended with such entire success that I will hereafter confine myself to a simple presentation of the testimony of those culturists who have made use of them, in order to recommend the adoption of my *economical* net.' He then cites, among other testimony, that of a distinguished culturist of Brest in the department of Drome, M. Fame de Laforet, who, after stating that his success that year (1839) had been greater than in any former season, adds: 'I owe this result to your paper nets, which I have used continually up to the time of mounting, to the number of 1,500, 2 feet wide and 4 feet long, corresponding with the size of my shelves. I have had a great many visiters who like myself have made use of the paper nets this year. Pierced according to the pattern of yours, my nets have worn very well; for I have had but 10 or 12 of them injured. I have no doubt that by another year the paper nets will be brought into general use throughout the country."

I will now furnish directions for making and using nets similar to mine, which I have found to accomplish well what is ascribed to the French nets.

These nets are made by providing a framework of light laths, 3 feet long and 2 feet wide, (this being the size most convenient,)—the two pieces of laths 3 feet long being united by three pieces 2 feet long, one at each end and one in the middle.—The holes (five-eights of an inch in diameter) are punched in sheets of strong brown paper, 3 feet long and 2 feet wide, to suit the frames on which they are pasted. The space between the holes may be about an inch.

With an instrument called a wad-cutter, twenty sheets of paper may be punched at once. Double sets of these nets will cost but little more than shelves of rough plank and if the frames are well put together with wrought nails, they will last more than twenty years. This paper will require renewing in every period of six or seven years. After the silk-worms have accomplished the *third* moulting, the nets may be laid over the worms daily, if the culturist desires it, up to the time of mounting, and the worms will be kept as clean as the most careful could desire, and with comparatively little labor.

The nets must not be laid over the worms when they are torpid; but after the third and *fourth* moultings, when nearly all the worms are aroused, they may be laid over them daily; and when the leaves are scattered over the paper, they will speedily extricate themselves from the litter, ascend through the holes and commence eating. The nets may be used with or without shelves under them; if without shelves, they can be supported by parallel slips of timber, about 20 inches apart; if placed on shelves, they must be raised about two inches by placing blocks of timber under each end. When these nets are used, disease cannot be produced by the accumulation of litter without gross negligence, yet no claim to *infallibility* is set up for them —Let silk culturists try them. They will be found simple, (a child can apply and use them,) *economical*, and very efficient. LAYTON Y. ATKINS.

Stafford County, (Va.,) Sept., 1841. [*National Intelligencer.*

SECRET FOR TAMING VICIOUS HORSES, &c.

Dear Sir,—My secret for taming Vicious Horses is gentleness and patience, which removes fear and gives the animal confidence in man. Rubbing a horse in the face will cause him to present his head to you, and talking kindly to him will attract his attention. After having cleared the stable or paddock of every thing (dogs, chickens, &c.) that will tend in any way to frighten the horse, drive him as gently as possible into a corner and approach him by degrees, that he may see that there is no cause for alarm. You must now rub his face gently downwards (not across nor "against the grain" of the hair,) and when he becomes reconciled to that, as you will perceive by his eye and countenance, rub his neck and back, till you come to his tail, repeating the operation several times till he will permit you to handle his tail freely. You may now lead him out, and call upon him constantly, in a steady tone, to come along, (whispering the words, to some horses, is better than to speak loud,) and in about ten minutes or less he will follow you about quite tame and gentle.

In breaking a horse to harness or saddle, you must be very gentle with him. For the former you may commence by throwing a rope over the back, and letting it hang loose on both sides, then lead him about, caressing him above until he becomes satisfied that they will not hurt him; then put on the harness, and pull gently on the traces—in a short time by this kind treatment he will be prepared for work.

In breaking for the saddle you may begin by shewing him the blanket, rubbing him with it, and throwing it on his back; in a short time you may lay the saddle on, and after fondling him for a few minutes you may fasten it and ride him with perfect safety. It is better for one person to stand by his head at first and keep him quiet; and then to lead him along until all danger is over. If he is dangerous, you may exercise him for some time, by leading him, and leaving as he becomes more and more gentle in working. You can then manage him with more safety. It is better to *work a horse* to make him very gentle; but if this cannot well be done, I would recommend the use of bit and harness, that he may learn to be governed by the bridle; be careful not to get his mouth sore. Put on at first a loose harness, and let it remain on for some time; if the harness is tight, it will make an unbroken horse sweat and faint. You may in the case of a very vicious horse side line him. In a little time he will pass a carriage without shying, and will not caper in gear or under the saddle.

If a horse lies down, and will not get up, drive a stake in the ground and fasten him down for ten or twelve hours, then loosen him, work him for about an hour, water and feed him, and he will "know better next time."

To prepare a horse for hunting, snap a few percussion caps about him—before and behind—by degrees increase the loudness of the report, and in half an hour you may fire a cannon near him.

A *vicious cow* may be cured by the same treatment.

To make a horse follow you.—You may make any man's horse follow you in ten minutes, or sometimes less; go to the horse, rub his face, jaw, and chin; leading him about, still saying to him, come along; a constant tone is necessary; by taking him away from persons and horses, repeat rubbing, leading, and stopping. Sometimes turn him round all ways, and keep his attention by saying, come along; put your arms around his neck, whispering in his ear, saying, come along. I suppose in some horses it is important to whisper to them, as it hides the secret, and gentles the horse; you may use any word you please, but be constant in your tone of voice. The same will cause all horses to follow. If a horse has an injury in the face, you had better put off taming him until it is well.

To manage a contrary race horse.—If he stops or sulks, go to him, and speak kindly to him; rub him down the face, using the bridle no more than you can help; turn him to the right or left,

until he starts, as he will be most apt to start, at the second or third motion, then continue rubbing him in the face, talking to him as in other cases, keeping him quiet by leading him about. Continue to rub him in the face, and use the same tone of voice.

To prevent a horse or mule from breaking his halter.—First strong halter him with one that will not draw, as that often makes his jaw sore; then fasten him to something which he cannot pull loose, and let him pull until he is unwilling to pull any more. You then get on and ride him a mile or two, and tie him so again, and let him stand quiet. By repeating this for a while, in regular use, you may turn him loose any where, and he will be safe. By the use of a good halter, a horse may be turned loose in a prairie to feed all night, and cannot be "stompeaded," or run off by wild horses; hundreds have thus been lost. Those who have no halters may with ease blindfold a horse, and then he will not run.

To teach a horse to lay down.—First with some soft handkerchief or cloth, tie one fore leg; then with a stick tap him on the other, and say "kneel," sometimes by rubbing him on the head, and patting him on the leg, you will induce him to lie down. It appears all horses are inclined to obey you, and will do so when you teach them that you will not hurt them. You will have to employ some time and attention; you had better take him by himself. Repeat the trial 3 or 4 times and you will be successful.

To accustom a horse to the use of a gun, umbrella, &c.—Commence by showing your friendship, by rubbing the horse's face with your hand; then snap and explode percussion caps with a pistol—let the horse frequently smell the powder and smoke; then you will fire small reports, until you shall see fear removed; then overhead, and behind the horse, until all is free. If you have a very wild horse, place him in a stall, or small pen, so as to have him safe; then fire a gun all around him, and go often up to him, speak to him and rub him in the face, and then fire the gun again, until he is free from starting. To make a horse used to an umbrella, walk before him, raising it up and shutting it again; let him smell it, and rub it over his head; then get on him, gently raise it and ride him along, until the fear is over. It is in all cases, better to take the horse to some new place away from home; for if you go to the place where he has been spoiled, you will find he is apt to prove unkinder there than elsewhere. Sometimes, horses will remember for 5 years, places and habits, both good and bad. You must rub your horse on both sides, for he may be gentle on one side, and not on the other.

How to manage a kicking horse.—First make a stall, or pen, for your horse, in which he cannot turn round, and with slats, through which you can put your hand to rub him.—Then commence by rubbing him in the face, and all over, two or three times, —raising his tail gently, three or four times; then touch one of his

fore-legs, and say to him "foot," "foot," until he shows willingness to raise his foot, raise the foot up, and put it down some three or four times; then go all round until all fear is removed. All you wish a horse to do, ought to be done three or four times, repeated two or three days in succession.

How to manage a cow.—Tie her to some place, so that you can rub her all over; then salt her from your hand; feed her from your hand, on half feed, and in three days you may do as you please with her. Rub her near the root of the tail, as that has a good effect.

Something like "Animal Magnetism!"—Take a chicken or a turkey, and lay it on its back: then with a piece of chalk draw your hand along before its face to the length of your arm, and it will lay still for some time. Then stand the chicken or turkey on its feet, and draw your hand down its bill, or draw a mark round it, and it will remain in this "magic ring" for a time!

In breaking a shy or skittish horse never strike him for swerving, but if he is frightened, be gentle; get down, rub him in the face, lead him to the cause of alarm, then back to where you got off, and then ride him back again to the object. Repeat this in the force of his habit, and he will be submissive. If an old horse, you may mend his habits. In training horses to go over bridges, it is a good plan to lead them over some three or four bridges.

To make a horse stand still while you mount.—Get on and dismount four or five times before you move him out of his tracks, and by repeating this any horse will stand still.

In conclusion, I would advise all breeders to be kind and gentle to their foals, and by so doing I will venture to say they will seldom have vicious horses to tame.

I am, Sir, your obedient servant,

D. O.

[*Spirit of the Times.*

CURING OF HAMS.

The article called *pyroligneous acid*, (or essence of smoke,) is much used in the curing of hams, and is preferable to the usual mode, in being a great saving of trouble and expense, and (as we think) favors the quality also. Our mode is as follows: after the hams have been three or four weeks in salt and pickle, take three pints of the acid to one barrel of hams, and mingle it in the barrel with the pickle and salt, and let the hams lie therein for three or four weeks.—They must then be washed off and hung up in a garret, or other dry place. They improve fast by age, and keep sweet in the hottest weather. After four years' experience we can safely recommend this mode. [*Long Island Star.*

HORTICULTURE.

AN OUTLINE OF THE FIRST PRINCIPLES OF HORTICULTURE;

BY JOHN LINDLEY, F. R. S. &C.

(Concluded from page 543.)

XI.—AIR AND LIGHT.

277. When an embryo plant (242.) is formed within its integuments, it is usually colourless, or nearly so; but, as soon as it begins to grow, that part which approaches the light (the stem) becomes coloured, while the opposite extremity (the root) remains colourless.

278. The parts exposed to the air absorb oxygen at night, absorb carbonic acid and part with oxygen again in daylight; and thus in the day-time purify the air, and render it fit for the respiration of man.

279. The intensity of this latter phænomenon is in proportion to the intensity of solar light to which leaves are directly exposed.

280. Its cause is the decomposition of carbonic acid, the extrication of oxygen, and the acquisition by the plant of carbon in a solid state; from which, modified by the peculiar vital actions of species, colour and secretions are supposed to result.

281. For it is found that the intensity of colour and the quantity of secretions are in proportion to the exposure to light and air, as is shown by the deeper colour of the upper side of leaves, &c.

282. And by the fact, that if plants be grown in air from which light is excluded, neither colour nor secretions are formed, as is exemplified in blanched vegetables; which, if even naturally poisonous, may, from want of exposure to light, become wholesome, as Celery.

283. When any colour appears in parts developed in the dark it is generally caused by the absorption of such colouring matter as pre-existed in the root or other body from which the blanched shoot proceeds, as in some kinds of Rhubarb when forced.

284. Or by the deposition of colouring matter formed by parts developed in light, as in the subterranean roots of Beet, Carrots, &c.

285. What is true of colour is also true of flavour, which equally depends upon light for its existence; because flavour is produced by chemical alterations in the sap caused by exposure to light. (229.)

286. The same thing occurs in regard to nutritive matter, which in like manner is formed by the exposure of leaves to light. Thus the Potato when forced in dark houses contains no more amylace-

ous matter than previously existed in the original tuber; but acquires it in abundance when placed in the light, and deposits it in proportion as it is influenced by light and air. Thus, also, if Peaches are grown in wooden houses, at a distance from the light, they will form so little nutritive matter as to be unable to support a crop of fruit, the greater part of which will fall off. And for a similar reason it is only the outside shoots of standard fruit trees that bear fruit. Considerations of this kind form in part the basis of pruning and training.

287. Light is the most powerful stimulus that can be employed to excite the vital actions of plants, and its energy is in proportion to its intensity; so that the direct rays of the sun will produce much more powerful effects than the diffused light of day.

288. Hence, if buds, that are very excitable are placed in diffused light, their excitability will be checked.

289. And if buds that are very torpid are exposed to direct light, they will be stimulated into action.

290. So that what parts of a tree shall first begin to grow in the spring may be determined at the will of the cultivator.

291. This is the key to some important practices in forcing.

292. This should also cause attention to be paid to shading buds from the direct rays of the sun in particular cases: as in that of cuttings, whose buds, if too rapidly excited, might exhaust their only reservoir of sap, the stem, before new roots were formed to repair such loss.

293. As plants derive an essential part of their food from the air (280.) by the action of light, it follows that in glass-houses those which admit the greatest portion of light are the best adapted for purposes of cultivation.

294. The proportion of opaque matter in the roof of a glass-house constructed of wood varies from 1-3 to 1-7, that of an iron-house does not exceed 1-23.

295. Therefore iron-roofed houses are in this respect better suited for cultivation than wooden-roofed houses.

296. And as it has been found by experiment, that light passes more freely through a curvelinear than through a plane roof, and through glass forming an acute angle with the horizon than through perpendicular glass, it follows that a curvelinear roof is best, and a plane roof with glass perpendicular sides is the worst adapted to the purposes of the cultivator.

297. For the same reason common green glass is less fitted for glazing forcing-houses than white crown glass.

298. Poisonous gases in very minute quantities act upon vegetation with great energy. A ten-thousandth part of sulphurous acid gas is quickly fatal to the life of plants; and hence the danger of flues heated by coal fires, and the impossibility of making many species grow in the vicinity of houses heated by coal fires, or in large towns.

XII.—PERSPIRATION.

299. It is not, however, exclusively by the action of light and air that the nature of sap is altered. Evaporation is constantly going on during the growth of a plant, and sometimes is so copious, that an individual will perspire its own weight of water in the course of 24 hours.

300. The loss thus occasioned by the leaves is supplied by crude fluid, absorbed by the roots, and conveyed up the stem with great rapidity.

301. The consequence of such copious perspiration is the separation and solidification of the carbonised matter that is produced for the peculiar secretions of a species.

302. For the maintenance of a plant in health, it is indispensable that the supply of fluid by the roots should be continual and uninterrupted.

303. If any thing causes perspiration to take place faster than it can be counteracted by the absorption of fluid from the earth, plants will be dried up and perish.

304. Such causes are, destruction of spongioles, an insufficient quantity of fluid in the soil, an exposure of the spongioles to occasional dryness, and a dry atmosphere.

305. The most ready means of counteracting the evil consequences of an imperfect action of the roots is by preventing or diminishing evaporation.

306. This is to be effected by rendering the atmosphere extremely humid.

307. Thus, in curvilinear iron hot-houses, in which the atmosphere becomes so dry in consequence of the heat that plants perish, it is necessary that the air should be rendered extremely humid, by throwing water upon the pavement, or by introducing steam.

308. And in transplantation in dry weather, evergreens, or plants in leaf, often die, because the spongioles are destroyed, or so far injured in the operation as to be unable to act, while the leaves never cease to perspire.

309. The greater certainty of transplanting plants that have been growing in pots is from this latter circumstance intelligible;

310. While the utility of putting cuttings or newly transplanted seedlings into a shady damp atmosphere, is explained by the necessity of hindering evaporation.

XIII.—CUTTINGS.

311. When a separate portion of a plant is caused to produce new roots and branches, and to increase an individual, it is a cutting.

312. Cuttings are of two sorts,—cuttings properly so called, and *eyes*. (319.)

313. A cutting consists of an internodium, or a part of one, with its nodus (59.) and leaf-bud.

314. When the internodium is plunged into the earth it attracts fluid from the soil, and nourishes the bud until it can feed itself.

315. The bud, feeding at first upon the matter in the internodium, gradually elongates upwards into a branch, and sends organised matter downwards, which becomes roots.

316. As soon as it has established communication with the soil, it becomes a new individual, exactly like that from which it was taken.

317. As it is the action of the leaf-buds that causes growth in a cutting, it follows that no cutting without a leaf-bud will grow;

318. Unless the cutting has great vitality and power of forming adventitious leaf-buds (119.), which sometimes happens.

319. An eye is a leaf-bud without an internodium.

320. It only differs from a cutting in having no reservoir of food on which to exist, and in emitting its roots immediately from the base of the leaf-bud into the soil.

321 As cuttings will very often, if not always, develope leaves before any powerful connection is formed between them and the soil, they are peculiarly liable to suffer from perspiration.

322. Hence the importance of maintaining their atmosphere in an uniform state of humidity, as is effected by putting bell or other glasses over them.

323. In this case, however, it is necessary that if air-tight covers are employed, such as bell glasses, they should be from time to time removed and replaced, for the sake of getting rid of excessive humidity.

324. Layers differ from cuttings in nothing except that they strike root into the soil while yet adhering to the parent plant.

325. Whatever is true of cuttings is true of layers, except that the latter are not liable to suffer by evaporation, because of their communication with the parent plant.

326. As cuttings strike roots into the earth by the action of leaves or leaf-buds, it might be supposed that they will strike most readily when the leaves or leaf-buds are in their greatest vigour.

327. Nevertheless, this power is controlled so much by the peculiar vital powers of different species, and by secondary considerations, that it is impossible to say that this is an absolute rule.

328. Thus Dahlias and other herbaceous plants will strike root freely when cuttings are very young; and Heaths, Azaleas, and other hard wooded plants, only when the wood has just begun to harden.

329. The former is, probably, owing to some specific vital excitability, the force of which we cannot appreciate; the latter either to a kind of torpor, which seems to seize such plants when their tissue is once emptied of fluid, or to a natural slowness to send

downwards woody matter, whether for wood or not, which is the real cause of their wood being harder.

330. If ripened cuttings are upon the whole the most fitted for multiplication, it is because their tissue is less absorbent than when younger, and that they are less likely to suffer from either repletion or evaporation.

331. For to gorge tissue with food, before leaves are in action to decompose and assimilate it, is prejudicial as to empty tissue by the action of leaves, before spongioles are prepared to replenish it.

332. For this reason pure silex, in which no stimulating substances are contained (silver sand), is the best adapted for promoting the rooting of cuttings that strike with difficulty.

333. And for the same reason cuttings with what gardeners call a *heel* to them, or a piece of the older wood, strike root more readily than such as are not so protected. The greater age of the tissue of the heel renders it less absorbent than tissue that is altogether newly formed.

334. It is to avoid the bad effect of evaporation that leaves are usually for the most part removed from a cutting, when it is first prepared.

XIV.—SCIONS.

335. A scion is a cutting (311.) which is caused to grow upon another plant, and not in earth.

336. Scions are of two sorts, scions properly so called, and *buds*. (354.)

337. Whatever is true of cuttings is true also of scions, all circumstances being equal.

338. When a scion is adapted to another plant, it attracts fluid from it for the nourishment of its leaf-buds until they can feed themselves.

339. Its buds thus fed gradually grow upwards into branches, and send woody matter downwards, which is analogous to roots.

340. At the same time the cellular substance of the scion and its *stock* adheres (19.) so as to form a complete organic union.

341. The woody matter descending from the buds passes through the cellular substance into the stock, where it occupies the same situation as would have been occupied by woody matter supplied by buds belonging to the stock itself.

342. Once united, the scion covers the wood of the stock with new wood, and causes the production of new roots.

343. But the character of the woody matter sent down by the scion over the wood of the stock being determined by the cellular substance, which has exclusively a horizontal developement (73.), it follows that the wood of the stock will always remain apparently the same, although it is furnished by the scion.

344. Some scions will grow upon a stock without being able to ransmit any woody matter into it; as some Cacti.

345. When this happens, the adhesion of the two takes place by the cellular substance only, and the union is so imperfect that a slight degree of violence suffices to dissever them.

346. And in such cases the buds are fed by their woody matter, which absorbs the ascending sap from the stock at the point where the adhesion has occurred; and the latter, never augmenting in diameter, is finally overgrown by the scion.

347. When, in such instances, the communication between the stock and the scion is so much interrupted that the sap can no longer ascend with sufficient rapidity into the branches, the latter die; as in many Peaches.

348. This incomplete union between the scion and its stock is owing to some constitutional or organic difference in the two.

349. Therefore care should be taken that when plants are grafted on one another their constitution should be as nearly as possible identical.

350. As adhesion of only an imperfect nature takes place when the scion and stock are, to a certain degree, dissimilar in constitution, so will no adhesion whatever occur when their constitutional differences are very decided.

351. Hence it is only species very nearly allied in nature that can be grafted on each other.

352. As only similar tissues will unite (19.), it is necessary in applying a scion to the stock that similar parts should be carefully adapted to each other; as bark to bark, cambium to cambium, and alburnum to alburnum.

353. The second is more especially requisite, because it is through the cambium that the woody matter sent downwards by the buds must pass; and also because cambium itself, being organised matter in an incipient state, will more readily form an adhesion than any other part.

354. The same principles apply to *buds*, which are to scions precisely what eyes (319.) are to cuttings.

355. Inarching is the same with reference to grafting that layering (324.) is with reference to striking by cuttings.

356. It serves to maintain the vitality of a scion until it can form an adhesion with its stock; and must be considered the most certain mode of grafting.

357. It is probable that every species of flowering plant, without exception, may be multiplied by grafting.

358. Nevertheless, there are many species and even tribes that never have been grafted.

359. It has been found that in the Vine and the Walnut this difficulty can be overcome by attention to their peculiar constitutions; and it is probable that the same attention will remove supposed difficulties in the case of other species.

XV.—TRANSPLANTATION.

360. Transplantation consists in removing a plant from the soil in which it is growing to some other soil.

361. If in the operation the plant is torpid, and its spongioles uninjured, the removal will not be productive of any interruption to the previous rate of growth.

362. And if it is growing, or evergreen, and the spongioles are uninjured, the removal will produce no further injury than may arise from the temporary suspension of the action of the spongioles, and the noncessation of perspiration during the operation.

363. So that transplantation may take at all seasons of the year, and under all circumstances, provided the spongioles are uninjured.

364. This applies to the largest trees as well as to the smallest herbs.

365. But as it is impossible to take plants out of the earth without destroying or injuring the spongioles, the evil consequences of such accidents must be remedied by the hindrance of evaporation.

366. Transplantation should therefore take place only when plants are torpid, and when their respiratory organs (leaves) are absent; or, if they never lose those organs, as evergreens, only at seasons when the atmosphere is periodically charged with humidity for some considerable time.

367. Old trees in which the roots are much injured form new ones so slowly, that they are very liable to be exhausted of sap by the absorption of their very numerous young buds before new spongioles can be formed.

368. The amputation of all their upper extremities is the most probable prevention of death: but in most cases injury of their roots is without a remedy.

369. Plants in pots being so circumstanced that the spongioles are protected from injury, can, however, be transplanted at all seasons, without any dangerous consequences.

VEGETABLE GARDEN.

POTATO—(*Solanum.*)

Under the ancient name of *Solanum* (which is not well defined) is classed the *Tomato*, Egg-plant, and several other species, and accounted of a poisonous nature. The nightshade belongs to this class, and is well known to be a deadly poison; but the varieties above named, including the root of the valuable potato, have happily proved otherwise. This root has now, and for some years past, formed, the rich man's luxury, and the poor man's bread. It is distinguished from the other varieties by the specific name *Tuberosum*, signifying tuberous-rooted.

Potato, the English name of this vegetable, is derived from its similarity to the Battata, the sweet potato of South America. It is supposed to be a native of that country, being grown in the neighborhood of Quito, where the Indian name of Papas (from the root) is given to it by the natives, and which formed a part of their food. There is no doubt but from that country, while it was in the possession of the Spaniards, the potato was early introduced into Europe, and particularly into Italy, where it was cultivated for some years before England was "blessed" with this "invaluable root."

On the quality of the potato, as used for food, a few words will suffice. It is the most nutritious of vegetables, where it agrees with the constitution. But this is not the case in some few instances, and particularly where there is a spare or thin habit of body. To those who are in the habit of taking much exercise this root is excellent food, as it strengthens the fibres, and yields a very considerable degree of nourishment.

Too little attention is generally paid to the dressing of it; for an indifferent potato becomes good when well cooked, and a superior one forms a delicious and most wholesome diet when cooked with attention. The following method was communicated to the author by an Irish gentleman, who was most particular with regard to the dressing of his potatoes. It is extremely simple; and, if generally practised, few complaints would be made of the watery and seemingly half done quality of the potatoes so often sent to table.

An untinned iron saucepan is always preferable for boiling potatoes. In preparing them they should never be peeled, or they cannot be well cooked, and much of their nutritious quality will be lost; they only require to be washed clean, and at farthest to be lightly scraped. After soaking for about an hour, put them into the saucepan with cold water enough to cover them, and when it begins to boil (which is the chief point to be observed in the cooking of them), let a tea cup full of cold water (rather more or less according to the quantity) be put in, which will check the boiling and allow time for the potatoes to be done all through, without their being in any danger of breaking; when they are sufficiently soft, which may be known by trying them with a fork, pour off the water, and let the saucepan with the potatoes continue for a short time over a gentle fire, and the heat will cause any remaining moisture to evaporate, when, after having been peeled, they will be fit for table. By this method of cooking (if strictly adhered to) they will be found, especially if of a good kind, to be very mealy, floury, and delicately tasted.

Various counties and places have their favourite sorts; which are perhaps equally good with those above enumerated. That the soil and climate, even of this country, will alter the nature of the

potato, the author can abundantly prove; for having planted, in the vicinity of London, some very fine early and mealy sorts which he had received from Cheshire, upon taking them up he found them both waxy and ill-flavored.

There are two general kinds of this plant, which are distinguished into the red-rooted, with purple flowers; and the white-rooted, with white flowers; but in raising the root from the seed, or apple, numerous kinds are constantly being introduced.*

Culture.----The culture of the potato, propagated as it is from the root, is so well known, that any labored dissertation on that subject would be deemed superfluous.

The first matter to be considered is the soil, which if of a sandy nature, is better calculated for the potato than a heavy soil, though both will do; but it may be observed that the roots come sweeter, and much more mealy in a light than a heavy soil. A light rich loam, neither too dry nor too moist, is best adapted for the growth of potatoes of the finest quality.

To obtain new varieties of the potato from seed, (of which one single sort will produce a score,) gather the ripest apples, as they are called in September or October; separate the seeds, and wash and dry them from the pulp, and preserve them in paper bags till spring. About the middle of April they should be sown thinly in shallow drills. When about two or three inches high, thin them to five or six inches' distance. Let them remain (keeping the seeds down) till the end of October, when the roots will furnish a supply of small potatoes. They must then be taken up, and a portion of the best preserved in sand for planting next spring in the usual way. Plant them, and let them have the ensuing summer's full growth till October, at which time the tubers will have obtained a sufficient size to determine their properties. Having considered not merely the flavor of each new variety, but the size, shape, and color, and also the comparative fertility and healthiness, earliness or lateness, reject or retain it for permanent culture accordingly.

Some persons, anxious to have new varieties, sow the seed on a slight hot-bed in February. When the plants rise to a few inches in height, some light rich mould should be put between them; give a little water occasionally, with plenty of air at such times as the weather will admit. Towards the end of April prepare some trenches similar to those made for celery; the plants must then be carefully taken up from the seed-bed, and planted at about eighteen inches distance, when a garden-pot should be placed over each till they are rooted, and they must afterwards be occasionally earthed up. The next year they will require a similar culture to that previously mentioned.

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* We omit the description of varieties, as they have not been successfully grown in this country.—Ed. So. Agr.

Early potatoes in the open ground. The two best sorts for that purpose are the ash-leaved kidney and the Brighton dwarf or frame.

Two methods of planting in the open ground have been practised with success, both in the south and north of England, but more particularly in Lancashire, where fine potatoes (raised according to the following method) have been on sale in the Manchester market by the 12th or 15th of May, and in some years as high as three shillings a pound.

For this purpose full-sized sets should be planted the first week in October, either on a south border or in any sheltered situation, (the more dry the better,) on which, after having been well dug up, the potatoes should be planted eight or nine inches deep, and about ten or twelve inches asunder, covering them up, and leaving the border as light as possible; and as a good covering of dry mulchy litter will be required, a crop of radishes may be sown, which will be cleared off in March, as by that time the plants will be showing themselves above ground; and if the weather should happen to be severe, a covering will be requisite. When the plants are fairly up, the hoe should be applied, which, in the course of a fortnight or three weeks, will want a repetition. They need not be earthed up unless very much exposed to the wind, when a little may be drawn about the plants to keep them steady. By this method the author has known potatoes gathered, and that not in the most favorable situations, before the above time.

The second method is from single eyes; and to forward their sprouting they should, early in the year, be laid upon dry straw in a warm loft or room, and when sprouted to the length of half an inch, or an inch, they should be carefully cut to a single eye, leaving a sufficient portion of tuber for support, and after laying a few days to dry, they may be planted in some warm place, from the middle of March, [February,] to the beginning of April, [March,] (choosing a dry time for that purpose,) in drills about two inches deep, a foot between each row, and six inches apart in the row. The covering in such cases will depend on the weather. Ere now the author has planted the dwarf frame (the ash-leaved kidney not being then known,) close under a south and west wall, which has come into use early in April. In the most southern parts of England potatoes planted whole in September have produced a crop of a good size at Christmas.

Potatoes intended for keeping should be fully ripened before being taken up; and for storing they should be laid up dry, and not in too large heaps, either in pits or otherwise; the pits should be three feet deep from the level of the ground (supposing them to be dry,) from six to eight feet broad, and of a length according to the quantity. They are best protected by a sort of thatch, to keep out the wet and frost, taking care that the ground is sufficiently dry

round the edges to keep out heavy rain or snow. There are many other ways of storing up potatoes; the best is certainly that by which they can be kept most effectually dry, and at the same time free from the influence of frost. Putting them into close houses and covering them well with straw is the most effectual method, and the one (when there is the conveniency) generally adopted. Placing the potatoes nearly upon a level with the surface of any spot of ground in a heap, and covering them with plenty of straw, then with turves, and lastly with earth, is also a simple and good method, especially if in very severe weather some dry mulchy stuff be thrown over the whole. Always be careful that the potatoes are in a dry state before being stored away, as in that lies the principal art of keeping them.

In whatever place potatoes are laid they should be frequently looked over, and kept loosened up so as to prevent them as much as possible from vegetating, which, if it goes to any extent, will deprive them of much of their farinaceous quality. None suffers more from this than the ash-leaved kidney, on which account it should not be stored much before Christmas, and should again be taken out at the end of February. If wanted for early planting, and the eyes are backward in growth, the method of forwarding them has been noticed.

In preparing the sets for planting, one strong eye is sufficient for any sort of potato, whether planted early or late; and in cutting, neither of the ends should be planted, these being more fit for the pigs, and, as before hinted, they are to be laid to dry for a few days previous to planting; and in planting, keep the eye, uppermost, and the stronger the eye has sprouted so much better will be the crop.

Potatoes of the middle size should be chosen for the sets; and it is held to be a good method to sort the potatoes before cutting them, as the smaller ones, if wanted, may be planted closer together.

Fresh stable dung should on no account be used as a manure for potatoes, as its powerful saline qualities not only affect the taste but also cause canker, while any undecayed litter lightens and gives free scope to the lateral shoots of the plants. Where manure is required, which is more likely to be the case in the market and cottager's garden than the gentleman's, the following composition will be found to suit the potato, in whatever way it is applied, whether in the drills or in beds, covering the sets with it, more or less, according to the state of the ground, and the whole about two or three inches thick with mould :—

Half rotten leaves of oak, beech, or any other trees, with decayed horse litter, thatch, or such like, with a tolerable quantity of well-sifted coal ashes, the whole blended together, and applied

more or less according to the state of the ground. If strong, it will be the means of lightening it; and if moist, of keeping it open.

Potatoes, with proper care, by going over the rows and rooting out such as have the least variation from the sort planted, either in leaf, bloom, or root, may, when once established, be kept true to their kind for many years; and, if planted annually on the same piece of ground, allowing at each planting a moderate covering over the roots with the compost before alluded to, or something similar; and, as a most essential matter, if the ground be kept clear of weeds, and as light as possible, they will produce equally as fine.

The time for planting potatoes for a principal crop rests principally with the proprietor or gardener, as they have been known to have done well from the last of November to the last of March; and, as a case in point, there have been produced on two acres two rood and twenty-four perch 858 bushels of fine potatoes, the sets not being planted before the 28th June. And the ash-leaved kidney, as mentioned by A. Knight, Esq., a gentleman to whom horticulture is so much indebted, when planted in a mild season, has produced 650 bushels an acre, each bushel weighing nearly eighty pounds; and great as this crop may seem, more have been produced on an acre, from two crops in one season, on the same ground; such is the astonishing increase of the potato.

(To be continued.)

FOREIGN GARDENING AND AGRICULTURE.

Sir John Sinclair in his "Correspondence" mentions, that the Danish gardeners cover the blossoms of their fruit-trees in the day-time, and expose them to the open air at night—thus keeping them back until the season is favorable. They alse raise, in the winter time, cauliflowers in their cellars, so as to be ready early in spring.

Tho same writer tells us, that the Flemish farmers pay great attention to the weeding of their lands. "The weeds collected in spring, particularly when boiled, are much relished by milch cows; and in various parts of Flanders the farmers get their lands weeded by the children of the neighbouring cottagers, solely for the privilege of procuring these weeds for their cows." Surely this a hint worth trying. It would help the farmer, and the cottage cow-keeper.

USEFUL INFORMATION TO GARDENERS.

To prevent birds destroying your seed-beds, place thin *white strings*, such as is commonly used in shops, across the beds, about an inch above the ground, fixed tight by wooden pegs. Where feathers, dead birds suspended, and other devices, have failed, this effectually *scares* the marauders. [*Magazine of Domestic Economy*.

THE FLOWER GARDEN.

MONOGRAPHY OF THE GENUS CAMELLIA, OR AN ESSAY ON ITS CULTURE, DESCRIPTION AND CLASSIFICATION.

BY THE ABBE BERLESE.

[Concluded from page 556.]

Translated from the French for the Horticultural Register, by Henry S. Dearborn.*

SYNOPTICAL TABLE.

Indicating the color of the Camellia, its name, the form of its flower, the species or variety from which it was produced, the place of its origin, and the period of its introduction into Europe.

The * designates the species from which all the varieties have been obtained.

FIRST GAMUT.

DEEP CHERRY RED.

(*Dominant color.* Carmine mixed with more or less vermillion, as in Nos. 4, 5, 6 and 7, of the colored table.)

Name of Camellia.	Form.	Species or variety.	Origin.	Introduction.
Alexandreana,	irreg. full,	warrata,	Europe,	Angers, Cachet, 1833.
Altheæflora,	irreg. dou.	rubra plena,	do.	England.
Atroviolacea,	reg. single,	single red,	do.	do.
Anemone mutabilis,	reg. full,	corollina,	do.	England.
Anemone var. rosea,	irreg. full,	warrata,	do.	England, Low.
Blackburniana,	reg. doub.	warrata,	do.	England.
Braxelliensis,	reg. s. d.	single red,	do.	Belgium.
Berlesiana fulgens,	reg. dou.	coccinea,	do.	Abbe Berlese.
Concinna,	reg. full,	coccinea,	do.	England.
Coccinea,	reg. dou.	single red,	do.	do.
Clintonia,	reg. single,	warrata,	America,	Floy, N. York.
Corollina,	reg. dou.	rubra plena,	Europe,	Eng., Chandler, 1819.
Dernii,	irreg. full,	single red,	do.	England.
Dilecta,	reg. dou.	single red,	do.	Germany.
Egertonia,	reg. dou.	rubricaulis,	do.	England.
Elphinstonia,	reg. doub.	warrata,	do.	do.
Flammea,	irreg. doub.	single red,	do.	do
Fulgida,	reg. sing.	single red,	do.	do
Fulgens,	reg. sing.	single red,	do.	do
Gloria Belgica,	reg. sing.	single red,	do.	Belgium.
Heugmaniana,	reg. s. d.	single red,	do.	England.
Hexangularis monstruosa,	reg. dou.	coccinea,	do.	do

Insignis purpurea,	reg. sing.	warrata,	Europe,	England.
Knightii,	reg. sing.	warrata,	do.	do
Kermesina,	irreg. dou.	single red,	do.	Germany.
Lindria,	irreg. s. d.	aitonia,	do.	England.
Lucida,	reg. dou.	single red,	do	do
Mme. Adelaide,	reg. dou.	single red,	do	Paris, Tamponet.
Milleri,	irreg. dou.	double red,	do	England.
Minuta,	irreg. full,	aitonia,	do	do
Myrtifolia,	reg. full,	unknown,	Japan,	England, 1808.
do. Grandiflora,	reg. full,	unknown,	China,	Paris, Noisette.
Papaveracea,	reg. sing.	single red,	Europe,	England.
Parksii vera,	irreg. full,	rubra plena,	do	do.
Præcellentissima,	reg. dou.	warrata,	do	Germany.
Pictorum coccinea,	reg. dou.	warrata,	do	Milan, Sacco.
Platipetala,	irreg. full,	rubra plena,	do	England.
*Rubra simplex,	reg. sing.	species,	Japan,	do. 1739.
Rubra plena,	irreg. full,	rubra simplex,	do	Eng., in 1794, by Preston.
Rubra maxima,	irreg. full,	do.	do	England.
Rossi,	irreg. full,	do.	Europe,	Germany.
Rex Bataviæ,	reg. dou.	rubricaulis,	do	Belgium.
Rawsiana or Roscii,	irreg. full,	rubra plena,	do	Germany.
Rossiana superba,	irreg. s. d.	rubra simplex,	do	Italy.
Sanguinea,	reg. sing.	do.	do	England.
Staminea plena,	irreg. full,	rubra plena,	do	Germany.
Superbissima,	reg. dou.	aitonia,	do	Milan, Sacco,
Sparmanniana,	reg. dou.	spathulata,	do	England.
Splendens vera,	reg. full,	rubra plena,	do	Eng., Clapponi.
Speciosa vera,	reg. full,	do.	Japan,	Capt. Rawes.
Tamponeana,	reg. dou	rubra simplex,	Europe,	Paris, Tamponet.
Warrata, or Ane.	reg. dou.	unknown,	do	England, 1816.

SECOND GAMUT.

CARNATION COLOR.

(*Dominant color*. Rose lake and cinnabar, as in Nos. 1, 2, of the colored table.)

Name of Camellia.	Form.	Species or variety.	Origin.	Introduction.
Albalutescens,	reg dou	pomp. s. f.	Europe,	England.
Incarnata,	reg. full,	unknown,	China,	Lady Hume, 1806.
Carnea,	reg. full,	do.	do	England, 1806.
Kewblusk,	reg. full,	do.	Europe,	England.

SECOND GAMUT.

ORANGE RED, MORE OR LESS DEEP.

(Lake mixed with red cinnabar, at in Nos. 1, 2, 3, 4, 5, 6, 7, and 8, of the colored table.)

Name of Camellia.	Form.	Species or variety.	Origin.	Introduction.
Anemone flora var. sinensis,	reg. full,	rubra plena,	Europe,	England.
Atrorubens,	irreg. full,	single red,	do.	do
Augusta rubra aurantiaca,	irreg. dou.	corallina,	do.	do.

Chandlerii,	reg. full,	corallina,	Europe,	Eng., Chandler, 1829.
Cactiflora,	reg. dou.	pink,	do	Italy, Milan.
Conspicua,	reg. full,	corallina,	do	England.
China, (Tat.)	irreg. full,	rubra plena,	do	do
China large,	irreg. full,	rubra plena,	do	do
Derbiana vera,	reg. dou.	corallina,	do	do
Eximia vera,	reg. full,	corallina,	do	do
Incomparabilis,	reg. sing.	aitonia,	do	Germany.
Ignescens,	irreg. dou.	single red,	do	do.
Lauckmanni,	reg. sing.	single red,	do	Belgium.
Magniflora plena,	reg. full,	rubra plena,	do	Eng., Hamet of Claftham.
Punicæflora,	irreg. s. d.	warrata,	do	Angers, Cachet, 1828.
Parviflora,	reg. full,	rubricaulis,	do	do do
Palmeri purple warrata,	irreg. dou.	warrata,	do	do do
Reewesii,	irreg. dou.	coccinea,	do	do do
Revisa,	irreg. dou.	pæoniæflora,	do	do do
Rivinii,	irreg. dou.	coccinea,	do	do do
Rives nova,	irreg. full,	rubra plena,	do	do do

FIRST GAMUT.

GROUND WHITE, SPOTTED OR STRIPED WITH ROSE.

FIRST DIVISION.

Name of Camellia.	Form.	Species or variety.	Origin.	Introduction.
Bancksii,	irreg. full,	pomponia,	Europe,	England.
Dianthiflora striata plena,	irreg. dou.	pomponia,	do.	Italy, Milan.
Delicatissima,	irreg. full,	pomp simp.	do.	England.
Elegantissima,	irreg. dou.	single red,	do	Germany.
Gloria mundi,	irreg full,	pomponia,	do	Belgium.
Imperialis,	irreg. full,	pomponia,	do	Eng., Press.
Imbrica alba,	reg. full,	alba simplex,	do	England,
Punctata simp.,	reg. sing.	single red,	do	Eng., Press.
Picturata,	irreg. full,	pink,	do	do. do.
Regina Galliarum,	irreg. full,	pomponia pl.	do	do. do.
Sabina,	irreg. dou.	unknown,	do	Hor. Society, London.
Stryphosa,	reg. dou.	unknown,	do	Germany.
Spoffortiana,	irreg. full,	warrata,	do	England.
Victoria antwerpiensis,	irreg. dou.	pink,	do	Belgium.

FIRST GAMUT.

GROUND ROSE STRIPED OR WITH CHERRY RED.

(As in No. 1, of the colored table.)

SECOND DIVISION.

Name of Camellia.	Form.	Species or variety.	Origin.	Introduction.
Colvilii vera,	irreg. full,	pomponia s.	Europe,	England, 1829.
Gray Venus or Eclipse,	irreg. full,	pomponia s.	do	Eng., Press.
Punctata major,	irreg. dou.	unknown,	do	do. do.

Punctata plena,	irreg. full,	pomponia s.	Europe,	Eng., Press.
Rosa Mundi,	irreg. full,	do.	do	do. do.
Splendida,	irreg. full,	do.	do	do. do.
Venusta,	irreg. full,	do.	do	do. do.

FIRST GAMUT.

GROUND CLEAR OR DEEP CHERRY RED, STRIPED WITH WHITE.

THIRD DIVISION.

Name of Camellia.	Form.	Species or variety.	Origin.	Introduction.
Aglee,	irreg. dou.	pink,	Europe,	France.
Adonidea,	irreg. full,	pomponia,	do.	Belgium.
Cariopyhllæ flora,	reg. sing.	warrata,	do	England.
Coronata rosea,	reg. dou.	coccinea,	do	England, Low.
Cardinalis,	irreg. s. d.	variegata,	do	Belgium.
Donklæri,	reg. s. d.	unknown,	Japan,	Siebold, 1833.
Fioniana,	irreg. dou.	variegata,	Europe,	Paris.
Melinetti,	irreg. dou.	pink,	do	Nantes, Melinet.
Marmorata,	irreg. dou.	do.	do	Belgium.
Phillippi I., or Mexicana,	irreg. dou.	do.	do	Milan, Sacco.
Variegata plena,	irreg. dou.	unknown,	Japan,	Eng., 1792, C. Conner.
do. Monstruosa,	irreg. dou.	do.	Europe,	England.
Versicolor,	irreg. dou.	pink,	do	do.

SECOND GAMUT.

BICOLORED FLOWERS.

GROUND YELLOWISH CARNATION STRIPED WITH WHITE.

FIRST DIVISION.

Name of Camellia.	Form.	Species or variety.	Origin.	Introduction.
Ochroleuca,	reg. dou.	unknown,	Japan,	Eng., Siebold, 1833.
Swetia vera,	reg. dou.	do.	Europe,	Eng., Swet.

SECOND GAMUT.

BICOLORED FLOWERS.

GROUND CLEAR OR DEEP ORANGE RED, STRIPED OR SPOTTED WITH WHITE.

SECOND DIVISION.

Name of Camellia.	Form.	Species or variety.	Origin.	Introduction
Chandlerii striata,	reg. full,	corallina,	Europe,	Eng., Chanler.
Cuninghami,	irreg. dou.	rubricaulis,	do.	do.
Imbricata tricolor,	irreg. s. d.	unknown,	Japan,	Siebold.
Laukiana,	irreg. full,	rubra simp.	Europe,	England.
Leana superba,	irreg. dou.	unknown,	Japan,	Eng., Siebold.
Master double red,	irreg. dou.	pink,	Europe,	England.
Warrata flammula,	irreg. s. d.	warrata,	do.	France.

HYACINTHS.

Growing Hyacinths in miscellaneous borders, among other flowers.—Fix on the spots where they are to be planted, and loosen the earth to the depth of a foot with the spade, breaking it fine, and taking care that the roots of the adjoining plants are cut off, so as not to interfere with those of the Hyacinths. Remove three or four inches of the soil, and then deposit three or four bulbs, one in the centre and the others round it, so as to form a centre not more than six inches in diameter. Press the roots firmly into the soil, and cover them, three or four inches deep, with the soil, if it is a common garden loam, and five or six inches if it is a light sand. Plant only roots of one colour together, and put in a stick to mark the spot, that they may not be interfered with before they come up, when the bed is being dug over in spring. The season for planting Hyacinths is October or November; but even December is not too late in mild seasons, and in favourable situations. In general, no protection from frost is requisite; for the Hyacinth is very hardy, and chiefly suffers from too much water, from snails, or from a disease called the canker. In heavy clayey soils, a small cone of soil may be raised over the roots to throw off the rain; but when this is done, the cone ought to be levelled down in February, before the plants come up; or a small gutter may be formed round each circle of bulbs, to drain off the wet. Where borders have a sloping surface, both these precautions are unnecessary; and hence, in the garden of the Zoological Society in the Regent's Park, Hyacinths are planted in the sloping borders, (though the soil is a strong clay,) in autumn, and flower vigorously every spring. Hyacinths thus treated will produce very fine flowers the first spring; and, even though not taken up, if they are not injured by canker, or slugs, or the roots of adjoining plants during summer, they will flower tolerably well the second, and even sometimes the third year; after which their flowers will become every year weaker and weaker, till at last the plants are not worth the room they take up in the border. If it is wished to preserve the roots in a vigorous state, they ought to be taken up after flowering when the leaves have faded, and kept in a dry airy shed, with the neck of the bulb turned down; and then planted in a properly prepared bed in autumn, where, after remaining two years, they will have recovered their vigour, and be fit to plant again in the border. Planting Hyacinths in miscellaneous borders is the most convenient mode for amateurs, and in general it produces the most agreeable effect in a private garden, for beds of Hyacinths have more the appearance of being cultivated for sale by a florist, though it must be confessed that stronger flowers are produced in this way, and the effect, considered by itself, is far more splendid.

Flowering Hyacinths in glasses of water is a very simple operation, and may be effected by filling the glass with water up to the neck; and then placing the bulb in the cup-shaped part of the glass intended to receive it, and renewing the water from time to time when it begins to get muddy. When the water is changed the bulb should not be taken out, unless the roots are short and few, but the hand should be put over the top of the glass so as to retain the bulb in its place, and the water carefully and slowly poured off. This is done to prevent any injury being done to the long roots, as they are very brittle and easily broken, and the plant is seriously injured by their being in an imperfect state. When one of the long roots is broken, it should be cut off with a sharp knife close to the bulb.

To grow Hyacinths in water-glasses to the greatest perfection, it is advisable first to plant the bulbs in soil, and when they have made roots of an inch or more in length, to take them up, wash the roots, and place the bulb in the glass. The use of previously planting the bulb in the soil is to cause it to throw out roots more freely; the stimulus of the moist earth being found more effective for this purpose than moisture alone. When the bulbs are put into the water, without previously planting them in the ground, the glasses may be kept for a few days in the dark, till the roots begin to grow; but as soon as this is the case, the glasses should be placed in a warm room near the light, when the plants will grow rapidly. Should the flower-stems appear weak, they may be supported by a slender prop fixed in a disk of wood, on which the glass may be placed as its base; or by any other elegant or convenient means. In choosing Hyacinths for water-glasses, the red and blue flowers are preferable to those which are white or yellow; the latter two having a fragrance too powerful for rooms, and, besides, they generally flower weaker in glasses than the others. In the windows of seed-shops we sometimes see Hyacinths or Narcissi with their flowers inverted in a glass of water, appearing as if they had grown in that position. They are, however, grown in the usual manner, with the glass inverted over the pot in which the flower is grown, and only turned and the glass filled up with water after the flower has expanded, the flower-pot being removed, and the bulb wrapped in wet moss. Sometimes another flower appears growing from the other end of the glass; but this is grown in another flower-pot in the usual way, and only removed to the glass when it is wanted to produce the proper effect. Deceptions of this kind cannot be considered in good taste, particularly at the present day, when people are so much better educated than formerly. Hyacinths flowered in water are seldom good for much afterwards; nevertheless, if the leaves are carefully preserved, and the plants, immediately that they have done flowering, are planted in a nursery-bed, they will recover their vigour in two or three years. It is also said that

sinking the bulb entirely in water after it has done flowering invigorates it, and will enable it to flower the second year; but I have never had an opportunity of proving this. A very small portion of common salt added to the water has been found to accelerate the growth of Hyacinths, and give a deeper green to their leaves; and keeping the water warm, say at a temperature of 60°, also accelerates their growth. It must, however, be remembered, that too much salt will kill the plants.

Growing Hyacinths in pots of soil requires no particular care. To insure a vigorous growth, the pots ought to be deeper than usual, and they need not be much wider at the top than at the bottom. The soil ought to be a sandy loam, mixed with rotten leaves or dung so thoroughly decayed as to have become a kind of mould, and the pots ought to be well drained. When first planted, which ought to be in September, or any period between that month and February, the bulbs may be kept in a cool place, and covered with soil or rotten tan, till the buds have begun to move; when the pots may be taken to the greenhouse or the windows of a warm room, and if the soil be watered with warm water they will grow so much the faster. When the plants have done flowering, they may be turned out of the pots with the balls of earth unbroken, into the common soil; and the bulbs may be taken up and dried when the leaves have decayed. Bulbs which have flowered in pots seldom flower vigorously the second year; and unless the amateur has abundance of room for a nursing-bed, and leisure to manage it, it is better to throw away at once bulbs which have been flowered either in pots or in water-glasses.

[*The Ladies' Companion to the Flower Garden.*

HOW TO DESTROY INSECTS ON FLOWERS.

A late English paper says, that Mr. Knight of Chelsea, an able cultivator of exotics, after trying in vain various expedients for banishing destructive insects from his hot-houses, thought of a plan which effectually clears the plants from dust as well as insects. He makes a solution of glue in warm water, in a large tub, and when sufficiently diluted by additions of warm water, and while yet hot, the whole infested plants are plunged into the liquid, and immediately returned to their place in the house. Thus a thin coat of the solution remains on every part of the plant incasing every insect in a vestment, in which they can neither breathe, eat nor move. The vestment hardens as it cools, and after a day or two it cracks and peels off the plant, bringing with it every insect which it involved.—This dipping, it will be observed, can only be performed on portable plants, or such as occupy pots or boxes not heavier than two men can carry in their arms. On large specimens, as orange trees and the like, the solution must be thrown on with a syringe, or applied with a soft brush.

THE ORCHARD.

CAUSES OF DECAY IN PEACH TREES, AND ITS PREVENTION.

To the early settlers of the West, the peach was a cheap and easily procured luxury. The kernel was planted in the fence corner, and grew and produced a thrifty and healthy tree, with but little care or culture, bearing large and regular crops of fine fruit, for a number of years.

This being the case, why do we find so much difficulty at the present day? How do we account for their success then, and for our frequent failures now?

In early times, when the whole face of the country was heavily timbered, our winters were less severe than they are now. Our climate, unlike that of Great Britain, seems to increase in rigor as the country is improved, until, at this time, the peach trees are not unfrequently winter-killed.

In addition to this, the following causes had their influence: The kernel was taken from the fruit of an unbudded tree; those being of course selected which produced good fruit—thus the influence exerted by the stock if evil, was avoided. The kernel was planted where it was meant to stand—the young tree escaping the mutilation and checks too often received in transplanting. It was left to grow pretty much in a state of nature, by which the stem was shaded from the injurious effects of the full blaze of a summer's sun; for this tree, like the beech, will not do well if so exposed. The soil was fresh and good, and kept the tree in a vigorous and growing state. The clearing being generally small, was in a great measure protected from late spring frosts. The disease called "yellows" had not shown itself, nor had the peach insect, the "*Ægeria exitiosa*" of naturalists.

Now, trees are bought from the nursery-men, the older and the larger the better! The stocks too often produced from the kernels of indifferent or even unhealthy peaches; allowed to grow two or three years before they are budded; dug up without care, and scarce a root, and certainly not a fibre, left for their support; the stems bruised and chafed, and closely pruned to proportion them to the mutilated roots. They are kept out of the ground for a length of time; conveyed to the planting ground unprotected; and there set out, in little holes, dug out of the sod, in thin, poor soil, where they are left to struggle through a year or two of a miserable, sickly existence. In the nursery-row, the top of the one protected the stem of the other; but now there is no such defence. The peach-fly deposites its eggs, which are left to hatch, and the worms commit their ravages undisturbed. And being

generally planted in an open, southern exposure, the blossom-buds swell too soon, and are destroyed by the first severe frost.

Let us now state what we consider to be the proper practice..

Select a piece of rich, new land; if a tolerably stiff loam, with a surface coating of leaf mould, on the north or north-east side of a hill, near a large water course, the crops will be more abundant and sure, though not so highly flavored as if grown in a sandy soil. Plough it deeply and carefully in the fall; and in addition, mark off the holes, and have them dug down to the sub-soil, or at least two spades deep, and six feet in diameter. If you intend purchasing trees of a nursery-man, which is the cheaper course, if you have one within reach, in whom you can depend, go as early as possible in the spring, and select young, thrifty trees, not more than one year from the bud, and two from the kernel. Have them taken up very carefully, so as not to destroy even a rootlet that can be avoided; dip the roots in sludge, if you have to carry them more than a mile, and plant them without delay. Throw some of the surface soil into the hole, after loosening the bottom with the spade; drive a stout stake into the centre, to which to fasten the tree; then place the tree close up alongside of the stake, and while an assistant throws in the surface soil round the roots, shake the tree gently, so as to allow the earth to run in and fill up every vacant space; taking care to spread the roots out regularly, and to plant it but very little, if any, deeper than it stood before. Tread the ground lightly; and after pouring a couple of buckets-full of water round the tree, and fastening it firmly to the stake with a soft band, you may consider the operation of planting completed as it ought to be. It is perfect folly to purchase trees and plant them, as they are usually planted. If the soil is not naturally rich, manure it all over, but do not put any round the roots of the trees—rich compost or mould from the woods or stable yard, may be placed immediately round the roots.

If it is intended to grow the trees from the kernel, select good ones, the produce of healthy trees. Bury them in about two or three inches of soil, as soon as practicable after they are taken from the peach. If they are in quantity, mix them with double their bulk of earth, and ridge them up in a safe part of the garden, covering the whole with an inch or two of soil, and leave them over winter. Towards the end of February, or first of March, examine them, and plant out such as have opened but without removing the shells. Put three or four where they are intended to stand; and in July or August, inoculate them with the kind of fruit you wish. In the fall or spring, all can be removed but one. Never put off inoculating till the second year. A peach orchard should be tended in some such crop as potatoes, beets, melons, sweet potatoes, &c., and if necessary to sow it down, let it be like clover;

taking care to keep a space round the tree, of six or eight feet in diameter, free from grass and weeds. Trees never do well, bear or thrive, in a meadow, or blue-grass sod.

For some years past, the insect called the "Peach fly," or "Peach-tree worm," has occasioned the ruin of thousands of trees in the West. [*Western Farmer's & Gardener's Almanac for* 1842.

STATE AGRICULTURAL SOCIETY.

The Anniversary meeting was held at Columbia on the 23d Nov., when the following gentlemen were elected officers for the ensuing year:—

WHITEMARSH B. SEABROOK, *President.*
Chancellor HARPER,
Chancellor DUNKIN,
Gen. JAS. GILLESPIE,
Major JOHN M. FELDER,
Col. R. F. W. ALLSTON, } *Vice Presidents.*
A. HAMILTON BOYKIN, of Camden, *Corresp. Secretary.*
J. B. DAVIS, of Monticello, *Record'g. Sec'ry. & Treas'r.*

The Anniversary Oration of the Society was delivered by Gen. J. H. Hammond. He did not advocate "popular book planting," but explained the difference between "planting" and "book farming," and gave the Society a plain practical view of all topics interesting to the Agriculturist of South-Carolina----spoke of our wants, our means, and the expedience to which we must resort in the event that the Gulph States progress in the same rapid rate of production which has marked their increase of our great staple for the last five years,----shewed that we had been stationary in the amount of our production of Cotton for a long series of years, whilst those infants of power, have extended their production tenfold----that whilst the short staple cotton planter would perhaps at some day not far distant, be compelled to abandon this branch of national industry, still the production of rice, and the various small grains for which we are now in part subservient to other States, might form profitable sources of Agricultural enterprise, especially rice, which can be cultivated with success two hundred miles from the sea coast. He pointed to our immense inland swamps and alluvial bottoms, now sources of pestilence and ill-health, which might be made to glitter with the golden loads of rich rice crops. He spoke of the increasing demand for this article of domestic consumption over the world. He also dwelt upon the attempt of England to extend the culture of cotton in the Indies with considerable plausibility. This Oration should be published, as it is truly valuable.

It will serve in future as a light in the dim distance to irradiate the dark gloom which has shrouded the fair fields of Ceres. Gen. H. has devoted much of his time to the advancement of Agriculture; and though his report on cotton, laid before this Society last year did not receive the sanction of all the Up Country planters, yet it is said to be eminently adapted to his section of the State, and the Society has wisely taken the hint to request essays and reports to suit localities.

District Societies of the States presented many valuable Essays on Domestic Economy and Agricultural improvement. The Essay from the Newberry Society was an able one, and I thought I detected the co-workings of that distinguished and zealous advocate for the fallen science, Judge O'Neall, and another very practical planter, Major P. Hair, of the same District, in its wholesome admonitions and practical recommendations. Another, of great importance to the Sea Island planter, was read by the Hon. Whitemarsh B. Seabrook, the able President of the Society. In this, the clear combination of science, with years of laborious and faithful observation, was manifested, and as I suspect he is the author, I must be allowed to add that if he had done no more than produce this Essay on the calture of Long Staple Cotton to advance the cause of Agriculture, for the benefit of that class to whom it is addressed—this claim would require years of the services of his associates to repay the benefit. South-Carolina has a planter whose name has spread over every manufacturing nation of Europe. His cotton, improved by careful attention, is now sought after by all the fine lace manufacturers of the Continent, and the name of Seabrook is familiar to the great marts of France, in Berlin, Florence, and even amongst the remote lace manufacturing peasantry of Switzerland.

The Society of Pendleton presented valuable papers, which will be published, together with all other communications of interest which were presented to the Society.

Col. Hampton presented for distribution amongst the members, two bushels of Moschete Grass Seed from the Moschete plains of Texas, which has proved itself peculiarly adapted to our soil and climate. It is the opinion of many persons that all grasses attempted to be cultivated, should be brought from a Southern latitude, that they might withstand our internal droughts in summer, and if this suggestion be true, the introduction of this grass will be of incalculable value to the rearers "of fancy stock" in our State, as it is a very succulent and nutricious grass. The District Societies were generally represented by Delegates, and the meeting excited much interest.

The exhibition of animals has been unusually fine this year, and though not more than half of the stock which was started for the

Cattle Show arrived, in consequence of the rainy weather, such as were presented, indicated a decided improvement, both in their condition and general superiority to those contending for the cup last year. Several of the animals that took prizes last year were exhibited, and were again successful competitors. It is commendable to the liberal public spirit of Col. Hampton to state that he received twelve premiums on his stock. Col. Taylor, Dr. Davis, Major Starke, Capt. Ward, Col. Davis, Dr. Parker, and Mr. Taylor, were amongst the successful competitors.

Two Durham bulls and one calf, one of the former, belonging to Col. H. 4 years old, and weighing 1838 lbs. the other owned by Mr. Ward, of Edgefield, the calf by Dr. Davis, of Fairfield, two milch cows and four Berkshire hogs of great beauty and size, attracted particular notice. The premiums, consisting of silver cups, of the value of about $600, were awarded to Col. Hampton, Dr. Davis of Fairfield, Col. B. F. Taylor, of this place, and Mr. Adams of Edgefield.

The Horses exhibited by Col. Hampton, were as fine specimens as I ever saw at any fair in the Union, and it is a matter of surprise, though not of regret to me, that his celebrated imported horse Monarch was regarded of secondary utility to imported Sovereign, for Agriculural purposes, though the fine size and compact appearance of Sovereign, was much in his favor. The young things brought up by Col. H. exhibited also, showed the marks and judicious care of a skilful breeder. Cattle of every variety were on the ground, but the beautiful and symmetrical short horns were the favorites, and received all the premiums. The Berkshire variety of Hogs was the favorite breed. Bakewell and South Down Sheep were regarded as beautiful specimens of the woolly tribe, and those bred in the State vied in perfection with the fine turned foreign specimens, thus adding another incentive to the improvement of this valuable and too long neglected branch of domestic usefulness. [*Correspondence of the Charleston Mercury.*

GARDENER'S CALENDAR FOR DECEMBER.

VEGETABLE GARDEN.

Sow peas, spinach, radishes, carrots, salsafy, lettuce, cabbages, beets, parsnips. Plant Irish potatoes, mazagon, and windsor beans. Transplant cabbages, lettuce and onions.

Remarks.—Any of the varieties of peas may be sown in this month. The Irish potatoes will come up so early as to have their tops destroyed by frosts, but they will not be injured materially, if at all, by this. All seeds sown during this month, except spinach, peas and beans, must be protected during the cold weather.